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The Standard Test in Industrial Arts

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THE industrial-arts teacher, just like the academic teacher, is confronted with the task of periodically testing his students. In order to pass judgment on the accomplishment of the student, the teacher must constantly check the product as it is being made, and then pass final judgment when it is finished. By means of verbal and written questions, he also tests the pupil as to the content of the course. Undoubtedly, the major thought for testing in the mind of the average teacher is to determine a school mark. This purpose is legitimate, but it is by no means the only one, and it is unfortunate that it has so long submerged many of the other and equally important reasons for testing. Other important reasons for testing are: (1) to make an inventory of the pupils' knowledge and skills; (2) to diagnose and find the learning difficulties of the student; (3) to check his progress from grade to grade; (4) to compare classes doing the same work in several schools in the same system; (5) to compare the work of one grade with that done in the preceding and following grades; (6) to compare the work of a given school with that done in other representative schools throughout the country; (7) to determine if certain goals have been reached; (8) to determine the value of different methods of teaching. The procedure used for testing depends upon what the teacher desires to know about his class or students. The following kinds of tests are available to the industrial-arts teacher.

I. The oral quiz.
II. The written test.
  1. The essay type.
  2. The new-type objective test.
    a) The informal test constructed by local teachers to measure achievement in terms of the local course of study.
    b) The published informal test without norms.
    c) The standard published test given under controlled conditions and furnished with norms.
III. The performance test.
  1. The locally constructed test.
  2. The standard test.

The only type of test which will achieve all the foregoing purposes is the standard test, and even this test has its limitations. For continuous testing, it is not an adequate measure of the local course of study, and many standard tests are not adequate diagnostic measures. However, it is obvious that the standard test is the only measure that will fulfill many of the purposes indicated.

The purpose of this article is to discuss the standard test from the standpoint of the industrial-arts teacher. While working in this field much information has come to the attention of the writers that indicates that there is considerable misunderstanding among industrial-arts teachers regarding the purpose and value of the standard test. Arguments are no longer needed to establish the value of the standard test in the minds of the academic teachers. If the standard test has value in the academic field, it certainly has value also for the industrial-arts teacher! It might help to clarify the situation if we give first a brief statement of the criteria used in the construction of a standard test and follow this with an illustration drawn from the construction of a standard mechanical-drawing test. Many of the criteria used for a standard test will be applicable also to an unstandardized test, if the test is to have any real value.

First, a test should be *valid*. This term has a very definite and accepted meaning in the field of educational measurements. It must not be confused with reliability, though there is obviously a relationship as will be seen later. *A test to be valid must measure what it claims to measure.* But how can we tell if it measures what it claims to measure? It is not possible in the limits of this article to enter into a full discussion of validity. However a brief statement will be made of the salient factors involved in test validation. Validation may be considered under four main heads. A test to be valid must:

1. Measure the objectives of the subject.
2. Measure the common content of representative courses of study.
3. Have discriminating value; that is, it must measure the best and not fail to measure the poorest pupil.
4. Have a significant correlation with certain outside criteria. This is a statistical determination of validity.

Second, a test should be *reliable*. This term also has an accepted meaning in educational measurements. *A test to be reliable must measure well, whatever it is measuring.* A student's scores on two successive testings

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with the same test or two alternate forms of the test should be relatively stable. It is obvious that if a pupil scores high on the first testing and low on the second testing, little or no confidence could be placed in either score. The closer the correspondence between the two results, the more reliable is the test. Reliability has a close relationship with validity. A test having high validity will have high reliability, but the reverse is not true. Inadequacy of sampling, a vital factor in validation of the test, reduces the reliability. Other things being equal, the longer an examination the more reliable it is. This must be obvious and has long been unconsciously recognized by all teachers. If a teacher is asked why he does not give a two-question examination, he would answer it is too short. This is merely another way of saying the sampling is inadequate, hence the test is unreliable.

Third, a test should be *objective*. This again is closely related to validity and reliability. Absence of objectivity reduces both; presence of objectivity raises both. *By "objectivity" is meant that the giving and scoring of the test does not allow the exercise of any personal judgment*. It should have especial meaning to an industrial-arts teacher. A boy in woodwork is not told to guess at his measurements, he is told to take a rule and measure. His measurements, if he uses his rule correctly, will thus be the same as those taken by any other boy, or by the teacher, on the same objects. How much progress in shopwork could be made by guessing at the measurements? Such guessing is equivalent to the subjectivity present in the essay-type examination. The use of the rule is equivalent to the use of objective questions in the measurement of pupil achievement. Directions and keys for scoring should be provided with the standard test so that the results will be the same, no matter who scores the test. Similarly, directions for administering should be so arranged that subjectivity is eliminated.

Fourth, a test should have *norms*. *"Norms" are median or average scores received from students of like school exposure taking the test under controlled conditions*. These norms should be based on a large number of cases distributed geographically so as to represent typical achievement for the country as a whole.

Fifth, it is desirable that a test should have at least two forms of *equivalent difficulty*. The two forms should consist of directly comparable tests, measuring the same ability, and sampling the same material, differing only in specific content. Such forms permit wider usefulness of the test, and offer the advantages of measuring progress, and retesting doubtful cases.

Sixth, a test should be as *easy to administer* and score as is consistent with its validity, reliability, and objectivity already explained. The pupil's response should be so elicited as to measure the ability being tested and not the ability to follow directions, or of speed in writing.

Seventh, a test should have provision, as far as possible, for *general diagnostic uses*. If the test is called a "diagnostic" test, this should be more than general. Test items measuring certain abilities or information should be grouped, so far as this is consistent with the criteria already noted, to determine strength and weakness of pupils tested without spending a large amount of time picking out the questions or problems concerned.

The authors' Industrial-Arts Test II–Mechanical Drawing will be used to illustrate the meaning of the above criteria of a standard test.

Validity of the test was based on the preliminary study of textbooks, courses of study, industrial-arts objectives, and reference books. On the basis of this study, an analysis of mechanical drawing was made. This analysis, as shown in the accompanying table, was sent to 85 teachers, supervisors, and directors of industrial arts in cities ranging in size from 1,000 to over 4,000,000 population. The responses obtained determined on a percentage basis, are given in the following table.

The most significant percentages, as far as the validation of the test is concerned, are those found in the last three columns which contain a summary of the results for all cities concerned in the study. A word or two of caution needs to be given here regarding the interpretation of the results shown in the table. The figures for the eighth, ninth, and tenth grades are not mutually exclusive. For example, take the item *a* — "attaching paper" — under "Use of Materials." The 62 per cent teaching this in ninth grade are unquestionably some of the same schools as in the 57 per cent for grade eight. This, in spite of the fact that the instructions sent out with the questionnaire, asked for a listing of the material only in the grade where it first appeared. However, as far as the study is concerned as a basis for the test, this inconsistency has no significance. The significant thing is where the material first appeared.

The authors used this extensive analysis as a basis for the test material.

Many items were subdivided and formed the basis of several questions. Process orders and teaching sequence were considered in both the information and the performance sections. The preliminary material was given to teachers of mechanical drawing and draftsmen. The criticisms of these men were incorporated in the first trial edition of the test. The test was then split into two forms each having two parts, part one being information relative to mechanical drawing and part two being performance.

The following description of the test will show that the test closely parallels instruction.

The test consists of two forms, I and II. Part I may be written in an ordinary classroom with pencil, while Part II requires the use of mechanical-drawing instruments.

Part I

Section A. Information relative to mechanical drawing. Recall questions (36 in Form I and 36 in Form II) and incomplete statements; multiple-choice response questions; four choice for completion; tests knowledge of the use of instruments; drawing to scale; dimensioning; allowances; machine and architectural conventions; symbols; finish marks the principles of orthographic projection; selection and placement of views; gear formula; materials used in mechanical drawing; machine-drawing materials and constructions; roof and stair formula, and sections.

Section B. Interpretation of drawings consists of three partially completed drawings. The student is to

ANALYSIS OF MECHANICAL DRAWING CONTENT

Percentage of Schools in Cities of Various Size Teaching Material in Grades 8 to 10

CONTENT	Cities of Various Sizes and Summary of All Cities																							
	A			B			C			D			E			F			All					
Grade	8	9	10	8	9	10	8	9	10	8	9	10	8	9	10	8	9	10	8	9	10			
I. USE OF MATERIALS																								
a. Attaching paper - paper	59	83	47	30	90	10	47	63	18	50	46	21	7	43	7	75	50		57	62	19			
b. Sharpening pencil - pencil	59	83	47	30	90	10	47	63	18	58	42	21	7	43	7	75	50		60	63	19			
c. Ruling lines-T.Sq.-triangle	47	83	47	30	90	10	47	60	18	50	58	25	7	43	7	75	50		56	65	20			
d. Drawing arcs - compass	34	83	47	30	90	10	43	72	22	41	75	20	14	36	7	75	75		41	75	20			
e. Irregular curves - French curve	12	34	22	20	60	40	18	66	38	29	75	31	14	29	21		50	25	21	64	36			
f. Measuring - working to scale	22	83	47	25	75	30	35	60	28	55	45	25	14	36	14	25	100		35	58	23			
g. Alphabet of line	34	83	47	35	75	20	37	61	18	55	45	21	14	43	7	75	50		42	62	19			
h. Order of penciling	12	68	47	25	70	20	39	62	18	48	54	25	7	43	7	75	50		37	63	21			
i. Order of inking	12	59	47	15	60	25	11	70	32	33	62	25	14	36	7	25	50	25	17	66	30			
II. LETTERING																								
a. Upper case letters	34	83	47	25	75	25	49	68	34	46	58	29	7	43	7	75	75	25	45	62	31			
b. Lower case letters	34	68	59	35	65	45	25	68	29	29	46	29	14	21	21	50	25	25	29	60	34			
III. TERMS AND DEFINITIONS	22	59	47	15	70	40	38	53	35	58	75	29		36	29	25	50		20	63	34			
IV. DIMENSIONING																								
a. Dimension lines	59	94	59	25	75	15	43	68	26	70	46	21	7	43	7	75	75		47	69	25			
b. Extension lines	59	94	59	25	70	20	43	68	26	70	46	21	7	43	7	75	75		47	68	24			
c. Figures	47	94	59	30	70	10	43	65	26	66	50	25	7	43		75	75		46	67	22			
d. Placement of dimensions	47	94	59	30	75	15	43	75	31	67	70	25	7	43	7	75	75		39	74	26			
e. Indicating feet and inches	59	94	59	30	60	15	35	77	31	54	79	25	14	43	21	50	50		40	75	28			
f. Placement of horizontal dimen.	34	94	59	30	65	15	40	71	29	67	67	21	7	43	7	75	75		44	72	25			
g. Placement of vertical dimen.	34	94	59	25	65	20	40	72	31	67	67	21	7	43	7	75	75		44	73	27			
h. Dimensioning of arcs- circles	34	94	59	25	50	30	35	71	32	50	79	21	7	29	14	50	75		39	73	29			
i. Dimensioning of irregular shapes	12	68	34	30	45	25	17	60	45	42	71	38	7	36	21	25	75		24	64	37			
j. Dimensioning sections	12	68	59	15	60	30	20	63	43	37	71	50	7	29	21	25	75		22	66	41			
k. Dimensioning within limits	12	59	47	20	60	30	17	43	49	42	54	54	7	21	14	25	50	25	21	48	45			
l. Finish marks and notes	12	59	22	10	35	45	9	48	46	33	50	67	7	29	21		100		14	51	46			
V. DRAWING INVOLVING ORTHOGRAPHIC PROJ.																								
a. Three-view drawing	47	83	59	25	75	25	43	71	31	58	71	33	14	43	7	75	75		44	73	29			
b. Sectional views	22	83	68	20	70	35	21	69	46	33	100	33		43	14	25	100		23	78	40			
c. Auxiliary views		34	59	10	55	35	46	66	45	33	58	54		43	14		50	50	10	62	42			
d. Revolution - horizontal axis		12	47		45	40	31	43	51	25	71	47		29	29		25	25	5	46	47			
e. Revolution - vertical axis		12	34		40	40	15	43	48	8	50	47		21	29		25	25	2	42	45			
f. Revolution - double			22		20	40	15	25	37	4	33	38		21	14			25		26	36			
VI. SKETCHING																								
a. Selection of views		59	47	20	50	50	26	42	44	38	59	42		14	29	25	50		24	47	42			
b. Making sketch	12	47	47	25	45	50	25	45	40	42	64	46		21	29	25	75		26	50	42			
c. Make measurements	12	34	47	15	40	50	23	42	46	42	64	46		21	29	25	75		23	48	46			
d. Dimensions, notes, specifications		22	59	15	45	35	17	43	46	21	8	58		14	29	25	75		16	46	46			
e. Checking sketch		12	22	15	30	35	9	41	40	42	50	50		14	29		50		14	41	39			
VII. WORKING DRAWINGS																								
a. Materials	12	22	68	15	30	50	20	42	53	41	54	38	7	21	36		50		21	20	48			
b. Screw threads			59		25	70	3	29	57	21	54	84		21	36	25	100		5	39	61			
c. Bolts and fastenings			34		25	65	2	27	58	16	54	80	7	7	36		50	25	5	32	60			
d. Conventional forms of holes		12	59	5	25	65	3	22	60	21	54	75	7	14	36	25	25	25	7	30	62			
e. Keys, spring and washers			22	5	25	60	4	11	60	21	29	80		21	36		75	25	4	23	60			
f. Finish marks, fillets, etc.		22	34		35	75	3	17	58	21	38	75	7	14	36		75	25	7	35	62			
g. Sections, pulleys and flywheels		22	22		40	65	2	22	66	21	54	75		14	29		50	25	5	35	58			
h. Bearings		12	34		35	60	2	17	61	16	41	75		14	21		50	25	4	29	58			
i. Couplings			12		15	60	2	17	61	16	38	75			21		25	25	4	22	55			
j. Gears and cams			12	5	20	70	6	2	48	16	21	75		7	29			25	4	8	50			
k. Detailed drawings		12	34	5	25	65	9	26	65	21	38	75		21	36		50	25	7	31	53			
l. Assembly drawings		12	34		30	65	3	29	67	16	41	75	7	21	29		50	25	9	34	61			
m. Tracing		12	68				3	29	67	25	67	46		14	29		100		6	44	60			
VIII. PICTORIAL DRAWING																								
a. Isometric		34	47	10	25	35	3	38	39	4	58	30		21	14		25	50	4	42	36			
b. Oblique		34	59	10	45	50	4	42	49	21	58	30	7	21	36		25	25	8	47	46			
c. Cabinet		22	47	5	30	35	6	42	40	29	58	25	7	7	29		25	25	9	36	29			
d. Perspective		12	34	5	25	50	3	18	42	33	46	33		36	43			50	8	26	44			
IX. DEVELOPMENT																								
a. Pyramids		22	34	5	50	35	12	45	43	21	41	46	7		29			50	11	40	22			
b. Cones		22	34	10	50	40	15	52	45	21	50	50		7	29		25	50	13	47	44			
c. Cylinders		22	34	5	50	45	12	50	47	21	50	50	7	7	29		25	50	11	45	48			
d. Triangulation		22	12	5	20	50	4	35	47	16	46	50		7	29		25	75	6	32	48			
e. Intersections		22	34		25	50	2	33	57	16	46	60		7	21		25	50	4	33	53			
X. GEOMETRIC CONSTRUCTION		59	47	20	60	45	25	54	40	29	75	12	7	21	14	25	50		22	62	33			
XI. BLUE PRINTING																								
a. Printing		22	68	10	25	45	12	37	53	50	62	38	7	14	43		75		16	40	50			
b. Washing		22	68	10	25	50	12	35	53	46	62	29	7	14	43		75		9	40	50			
c. Drying		22	68	10	25	50	12	34	53	46	62	29	7	14	43		75		15	40	46			
d. Filing		12	59	5	10	35	7	25	40	41	41	26		14	43		50		12	27	37			
XII. BLUE-PRINT READING																								
a. Three-view principle	12	22	34	15	25	30	7	32	40	29	34	12		14	21	50	25		11	30	32			
b. Section		22	34	10	25	30	4	25	40	21	34	16		14	29	25	25		8	27	34			
c. Dimension and notes		22	34	10	25	30	4	25	42	29	29	12		21	21	50	25		9	26	33			
d. Sketching		22	22	5	25	30	4	21	40	21	29	12		21	21	25			7	24	31			
e. Reading blue prints		22	22	5	20	35	3	28	40	25	29	16		21	21	50	25	25	7	27	34			
XIII. ARCHITECTURAL DRAWINGS																								
a. Architectural conventions			47		15	35	4	11	57		21	54		7	36		25	25	2	13	52			
b. Small buildings, e.g. garage			47		15	35	3	11	57		16	41		7	36		25	25	1	13	49			
c. Elevations and plans-larger bldgs.			34		10	40	2	1	53		4	62			21			25						
d. Details			47		10	35	2	2	55			54			29		25	25						
e. Preliminary sketches			47		10	35	2	16	47			50			21			25						
f. Display and competitive drawings					5	20	2	35	18			41			14			25						
XIV. SHEET-METAL DRAWINGS		12	22		40	40	2	28	44	4	30	48		14	14		25		6	37	40			
XV. ELECTRICAL DRAFTING			12		5	15	2	8	23		4	25		7	21			25		7	21			

A -- Cities of 1,000 to 5,000 population
B -- Cities of 5,001 to 25,000 population
C -- Cities of 25,001 to 100,000 population
D -- Cities of 100,001 to 200,000 population
E -- Cities of 200,001 to 1,000,000 population
F -- Over 1,000,000 population

read the drawing, putting in the missing lines to complete the drawings. His power to visualize and make the proper solution is tested.

Section C. Machine-drawing convention consists of three drawings of partially completed drawings of square and V-shaped threads and tapped holes which are to be completed by supplying the missing lines or giving the information asked for. The solution given indicates definitely whether he can or cannot draw these conventions.

Part II

Section A. Lettering provides two sets of guide lines for upper-case letters and two for lower-case letters. The student is required to letter given words and numerals in a space provided for that purpose.

Section B. Consists of a drawing with no dimensions given. The object is to be dimensioned from the printed specifications above the drawing.

Section C. Form I — A working drawing partially drawn is given. The student's ability to make a drawing is shown by his success in drawing the two views asked for, using the notes to aid in the solution.

Section C. Form II — A bill of material consists of a drawing of a piece of furniture with a blank form at the right in which the bill of material is to be filled in. The ability to read a drawing and make a bill of material for it is measured.

Section D. Orthographic drawing consists of four drawings requiring completion and involves cut surfaces, views drawn at an angle to the horizontal and vertical planes, and sectioning. Further knowledge than was necessary in Part I is required in this section.

Section E. Geometric constructions. The student's ability to solve common geometric problems is evidenced here.

Section F. Developments. Two problems are listed, one requiring solution by the use of parallel-line development and one by the use of radial development.

Section G. Pictorial drawing. One problem testing the ability to do cabinet or isometric drawing of a simple object.

The questions were checked as to difficulty and discriminatory value. No student made a perfect score, no one failed to score, and no question was missed by all. The percentage curves given in the manual show that the scores distributed themselves well, approximating the normal curve. It was stated also in the criteria that there should exist a significant correlation with certain outside criteria. About the only outside criteria available in this instance are teachers' marks. The correlation between this test and teachers' marks was found to be .65. This is a significant correlation in view of the criteria used. It approaches the correlations obtained in the academic field. A very high correlation cannot be expected, since the teachers' marks are admittedly subjective and include other factors than pure achievement. However, had the correlation been around .30 it would indicate, though not prove, the invalidity of the test as a measure of mechanical drawing.

If there existed other accepted valuable standard tests in mechanical drawing covering information and performance, these could have been used as outside criteria. However, no such tests exist.

The reliability of the test was found by determining the coefficient of correlation between the two forms of the test. This was found to be .87 (203 cases). We have not the space here to enter into a discussion of why .87 is a significant correlation and say .65 would not be. A bare statement of the facts will have to suffice. A correlation of .65 indicates too much unreliability of measurement. A reliability correlation of .87 compares very favorably with the reliability of the best tests in the academic field. While not guaranteeing perfect measurement, it indicates measurement in which confidence can be placed.

Objectivity in scoring is obtained by comparing the responses of the pupil with a key. This key has (1) words or numbers to which the scorer compares pupil's responses, (2) a lettering scale for assigning a quality score for lettering, and (3) a stencil key for checking sketches and mechanical drawings. Complete directions for scoring each part and the computing of the scores is given. The manual of directions provides for the giving of the test under uniform conditions.

The two forms to the test were tentatively equalized on 500 ninth and tenth graders in mechanical drawing. The norms as established showed the forms to be equal within 1 to 3 points. This is very significant when the type of material in the test is considered.

In the academic field, norms are established on a grade basis. Such a determination would be impossible in the field of industrial arts. The reasons for this are obvious. No two schools devote the same amount of time to industrial-arts work, nor offer the work in the same grades in junior and senior high schools. For example, one school (A) offers 1,200 minutes per semester in 8B, while another school (B) does not offer mechanical drawing until 9B. However, at the end of 10A school A has devoted only 18,000 minutes to mechanical drawing, while school B has devoted twice that amount of time, or 36,000 minutes. This merely illustrates a situation familiar to all industrial-arts teachers and is doubtless one reason for the slow appearance of standard tests in this field.

The problem has been met here as in the authors' previous industrial-arts tests by computing norms on a time basis. The times shown in Table I in the manual of directions, are the average total time spent on mechanical drawing by the classes used in calculating the norms. By "total time" is meant the time spent in that particular grade and all preceding grades. This fact must be borne in mind in a consideration of the norms. For example, the difference between the norms on the total test for fourth and fifth semesters on Form II is 3 points. This may seem a small difference, but the total time spent during these semesters which scattered through five semesters means a difference of about three minutes a day. This difference does not represent the difference in terms that will actually be found in any average school. For the average school the time separating these semesters of work would be represented better probably by fourth and sixth semesters' time. However, in order to make the norms as valuable as possible, classes were grouped on a time basis; and the groupings which showed a real difference in achievement used for the time norms. The norms were based on the median scores of the group used.

Two other kind of norms are given. These are, Percentile Norms and Best-Score Norms. Such addi-

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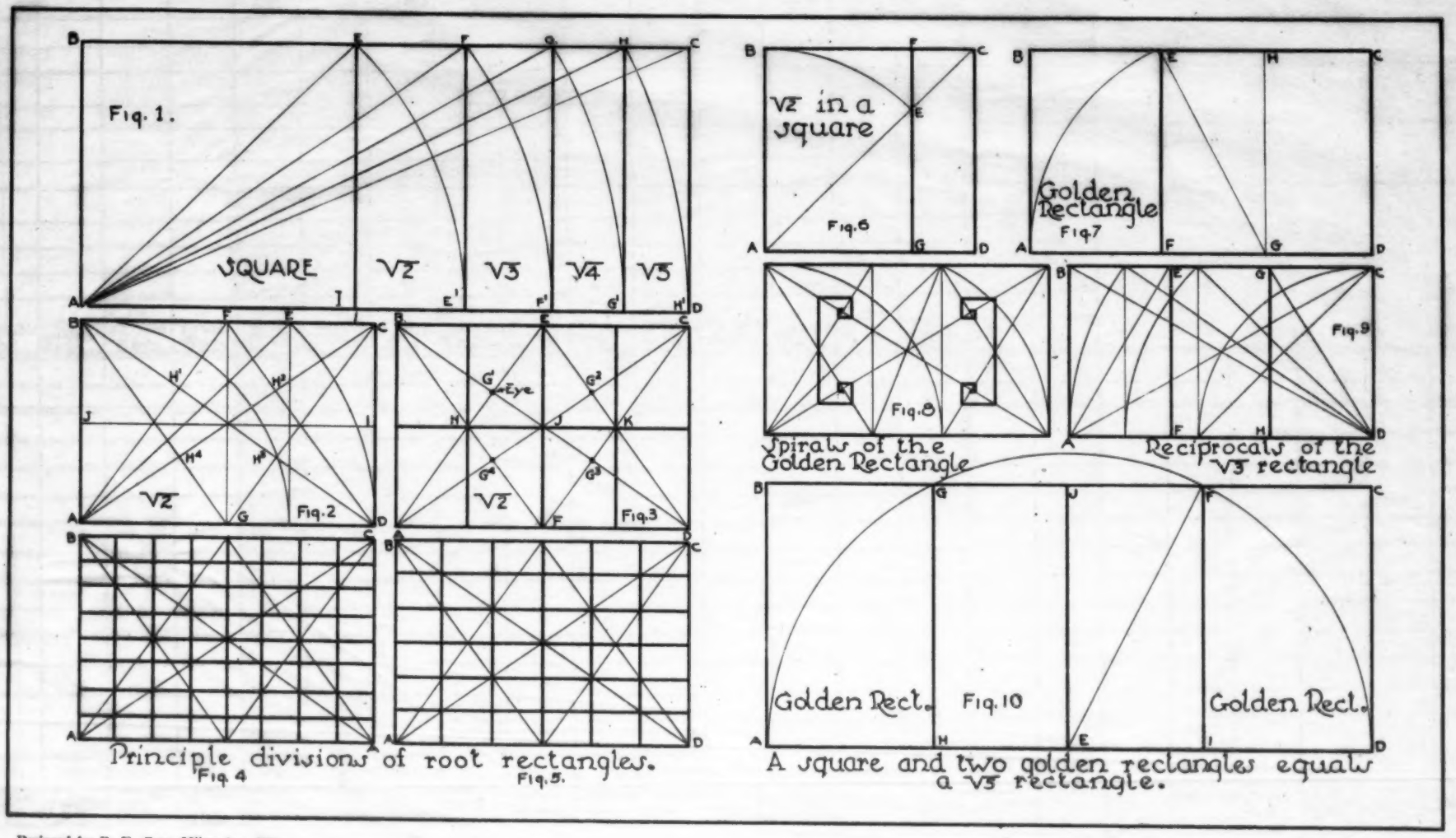

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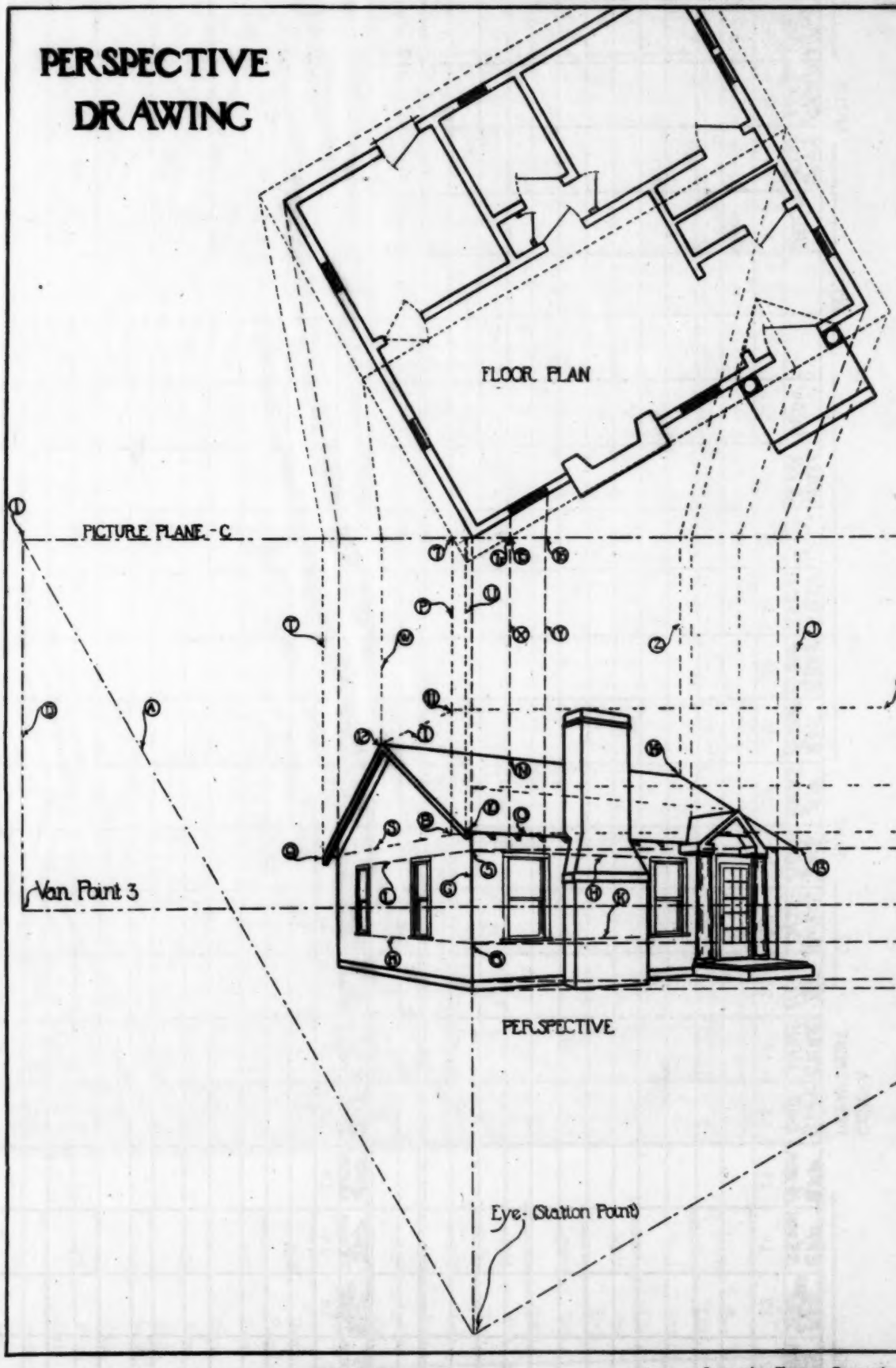
PERSPECTIVE DRAWING



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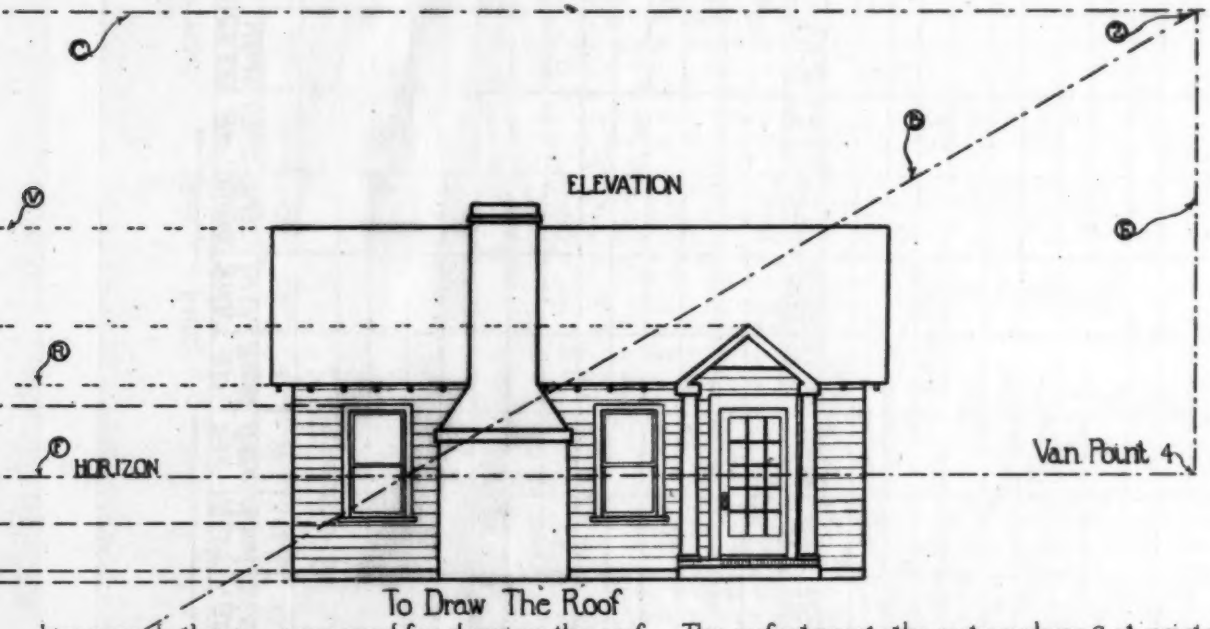
ORDER OF PROCEDURE

Place the floor plan on any angle desired at the top of the drawing board.

Place the elevation of the house opposite the sheet on which the perspective is to appear.

Locate the eye 50 or 60 feet from the floor plan. Draw the lines A and B (—·—) parallel to the respective sides of the house as these sides appear on the floor plan. Extend the lines A and B to their intersections with the horizontal line C (—·—) at points 1 and 2. Drop the vertical lines D & E (—·—) from points 1 and 2 to their intersections with the horizon line F (—·—) at points 3 and 4. These points are the true vanishing points. The horizon line, F, may be placed at any height, but is usually made 3 or 4 feet above the grade line on the elevation. To locate windows, corners, etc. on the perspective, extend lines (- - - -) from the floor plan toward the eye until they cross line C at points 15 and 16. From these points draw lines X and Y vertically downward to perspective view of each respective part. To get the height of doors, windows, etc., draw horizontal lines (— — —) from elevation to intersect corner line G at points 5 & 6. From these points draw lines H,K,L,M toward vanishing points.



To Draw The Roof

Lines made thus (- - -) are used for drawing the roof. The roof intersects the picture plane C at points 7 and 7x. From one of these points (7 in this case) extend the vertical line P downward. From the elevation of the roof project lines V and R to their intersections with this vertical line P at points 8 and 11. From these points draw the lines S and T toward the vanishing point. The line S intersects lines T and U at points 9 and 10, respectively, and line T intersects line W at 12. By joining these three points the outline of the gable is obtained. The ridge and cornice are found by extending lines N and O toward the vanishing point 4 to their intersections with the lines Z and J at 14 and 13 respectively.

ive Drawing by H. H. Robinson, Augusta, Kansas

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APRIL, 1930

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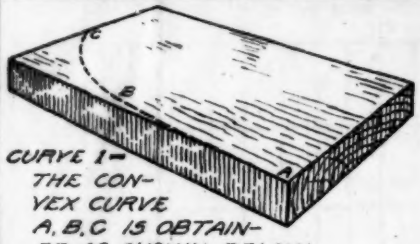
ELE. WOODWORK
CLIFFORD B. SMITH

CURVED EDGES

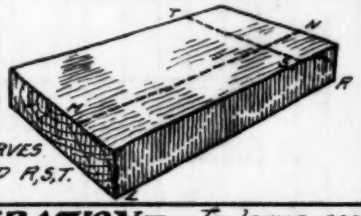
UNIT INSTRUCTION SHEET W-20



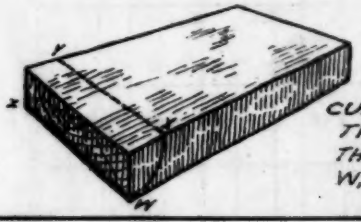
CURVE 1— THE CONVEX CURVE A, B, C IS OBTAINED AS SHOWN BELOW UNDER 1.

CURVE 3— THE CONCAVE CURVE G, H IS EXPLAINED UNDER POINT 3.

CURVE 2— THE SHARP CONVEX CURVE E, F IS EXPLAINED IN POINT 2.



CURVE 4— HERE WE HAVE TWO QUARTER ROUND CURVES L, M, N AND R, S, T.



CURVE 5— THIS EXLAINS THE HOLLOW W, X, Y, Z.

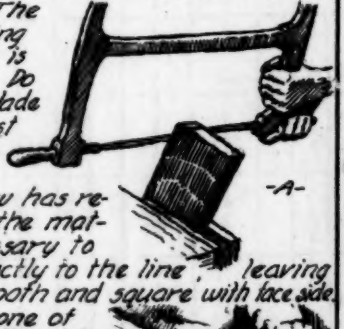
THE OPERATION— To learn good methods of working to a curve.

MATERIALS— They will be the particular piece or pieces that you are working on.

TOOLS— Band or turning saw, spokeshave, drawknife, block and jack planes, chisel, inside bevel gouge, try square.

DIRECTIONS— You must have keen tools. Take time to grind and oilstone all that need it.

CURVE 1— Saw just outside the curve if you are using a band saw. If you do this with a turning saw, it would be better to remain ⅛ away. The method of holding the turning saw is illustrated at -A-. Do not allow the blade to be twisted. Test blade for squareness with work.



After the saw has removed most of the material it is necessary to work down exactly to the line, leaving the surface smooth and square with face side. A spokeshave is one of the best tools with which to do this. The sketch at -B- shows how to do this with the tool taking a sliding cut. Adjust the spokeshave for a fine shaving. This is done by loosening the cap, setting cutter back and then tapping it out, (so it will just cut) with the hammer. Take care that you work with the grain.

CURVE 2— There are times when the spokeshave cannot be used. The curve E-F is rather too hard for it. This curve can be pared with a chisel. Hold the work firmly on a piece of scrap wood as shown at -C-. Note the slant of the chisel for a paring cut. Test for squareness.

CURVE 3— This concave curve cannot be touched with either a spokeshave or a chisel. The first thought of the average boy is the file. But the file should be the tool of last resort.

This type of curve should be cut with an inside bevel gouge. Select one that is as near the shape of the curve as possible. Clamp the work firmly to the bench top with scrap wood between. The gouge must be very keen. Hold gouge absolutely vertical to obtain a square cut. Work gradually back to the line using a twisting motion to produce a smoother cut. Cut with middle of edge.

CURVE 4— The quarter round on the end grain should be planed before the one on the edge. Sketch -E- shows how the plane is held, for a sliding cut with the motion directly across, as the arrows show. At -F- is shown the method of planing a quarter round on the edge. Keep changing cut.

CURVE 5— For this curve, as for number 3, we will use an inside bevel gouge. Do not allow the corners of gouge to cut, but rather take a light cut with middle part of cutting edge.

QUESTIONS— What is the objection to the use of the file in woodwork? In the sketches above, in most cases, a sliding or twisting movement is given the cutting edge. Why? In general which tools are to be preferred, cutting or scraping tools? Is there a difference in the texture of the surface left by each? Why are scraping tools ever used? When?

Designed by Clifford B. Smith, Buffalo, New York

tional norms enable the teacher to make a more refined interpretation of the pupils' scores and class results. The percentile norm is based on percentile rank. By the "percentile rank" of a pupil is meant the per cent of pupils in general whom he exceeds in score. Corresponding to the percentile rank will be found a school mark. For example, if a pupil in the third semester makes a score of 53 on the total test (Form I), he has a percentile rank of 75, which means that he made a score better than 75 per cent of this group.

The Best-Score Norm is the median score made by the best school in the semester indicated. While this hardly can be called maximum achievement for average classes and pupils, it can be well considered as a reasonable attainment for average classes and pupils in schools with average equipment.

The norms for each form are based on approximately 2,500 cases. For the second to ninth semesters, about 300 cases are included while in the first and tenth semesters the case numbers were smaller. The number of cases is not the only indication of reliable norms. The schools must be representative schools. Those used in our standardization were located in the following states: New York, Pennsylvania, Massachusetts, Ohio, Illinois, Michigan, Colorado, California, Wisconsin, Connecticut, Minnesota, New Jersey, Oklahoma, and Arkansas.

The ease of scoring and administration are provided for as far as is consistent with the validity, reliability, and objectivity of the test. Responses can be readily checked by the keys furnished.

General diagnostic value has been obtained by the grouping of problems under headings such as developments, lettering dimensioning, and so forth. This is significant and increases the usefulness of the test.

Conclusion

A standard test is not to set standards or determine objectives of teaching. In the industrial-arts field, as in other fields, the standard test merely measures what is being done in terms of accepted industrial-arts objectives. As the objectives change, tests will have to be constructed to meet the changing objectives and teaching emphasis.

Dynamic Furniture Design

*R. E. Cote**

(See Supplement No. 173)

"The chief forms of beauty are order and symmetry and definiteness, which the mathematical sciences demonstrate in a special degree."—Aristotle, *Metaphysica*, b.xiii, c.iii.

THERE has been a widespread misunderstanding of the essential simplicity of *dynamic symmetry*. Some are afraid of using it, because they think the work will become hard and mechanical, and the creative ability of the individual may be hampered. Greek designers always fixed the limits of their compositions but worked quite freely within these bounds, thus enabling them to obtain a high degree of perfection without becoming mechanical and stilted.

Modern design is quite the opposite. It indicates limits loosely fixed but very mechanically done in regard to details. In answer to this, one might ask "Does dynamic symmetry always produce good results?" Mankind as yet has not discovered a substitute for brains. Contrary to general thought, dynamic symmetry allows one to pick and choose rather freely, hence there is a chance also that some will pick and choose unwisely. This system must therefore be considered as a tool whose use demands much thought and time. It is not sufficient to divide an area minutely, then haphazardly pick a number of points, and draw a design to include them. To be practical the areas chosen must form a rhythmical arrangement of parts.

Dynamic symmetry is a system of obtaining uniformity, good proportion, and balance by diagonals and reciprocals to rectangular areas. The name *dynamic* means having force, a proportion suggesting power and movement, while *symmetry* is a definite system of measurement of space intervals within fixed limits. The necessity for symmetry will be obvious when it is realized that design does not live without it.

In practically all furniture design the *law of symmetry* must be observed. A piece of furniture in two or three dimensions, to please the eye, must have due proportion of parts in relation to each other; beauty, the real value of the work, lies in the way space relationship is exemplified. These spaces may be simple, or quite complex, but they still must satisfy the laws of proportion.

It is evident that a design whose dimensions coincide with areas that are in relation to one another, and also to the figure that they form collectively, must be in harmony, which cannot be achieved by good taste alone. Dividing the original area into smaller related areas automatically places at one's disposal, forms which subsequently eliminate unrelated and discordant forms.

Demonstration

"How shall I begin?"

Begin with a definite area. This may not be quite so obvious as one might first think, for many designers begin work without any thought of a shape. "Without a reason design is nil," for design implies definiteness of purpose.

The only instruments that the originators of dynamic symmetry used were a straightedge, a right angle, and a compass, and we can do the same if we wish. The Greeks used, preferably, certain highly interesting rectangles originating from a square and its diagonals which they subdivided into proportionate areas related to the original area by simple, logically drawn lines

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starting with the diagonals of the whole area, and the perpendiculars to them drawn from the opposite corners of the rectangle. These perpendiculars they extended to the opposite sides, and from each of these intersecting points, lines parallel to the sides were drawn which formed a reciprocal or similar area.

At this point it is advisable to analyze Supplement No. 173. This will show how the principal rectangle and its divisions are made.

Figure 1. Starts with the square with a given dimension AB. The square is Root 1. Extend lines BE and AI to the right. Next, take the compass with the diagonal AE of the square as a radius and A as a center, and swing an arc down until it crosses the lower line AI extended. At this point of crossing, erect a perpendicular which completes the rectangle BFE'A. This forms a Root 2 rectangle. Draw the diagonal of Root 2 and set your compass with this diagonal, AF, as a radius and swing an arc down to the lower line just as before. Erect the perpendicular F'G and complete the rectangle BGF'A. A is a constant center. This performance is repeated over and over, but it is advisable not to go beyond a Root 5 rectangle, as larger ones are not as pleasing.

Figure 2. This rectangle is a Root 2 rectangle and shows the principal division lines. AC and BD are the diagonals of the rectangle. From each one of the corners draw a line at right angles to the diagonals. AF is a line so drawn and intersects the diagonal BD at H'. This point H' is known as an "eye" of the rectangle. Similarly, three other such points may be found in this rectangle. JI and FG are the center lines of the rectangle.

Figure 3. This rectangle is a duplicate of Figure 2, but the construction lines used to establish the limits of the rectangles have been omitted, as they are not used, except as described in Figure 1. Instead, the principal divisions are shown and arrived at by drawing these lines through the intersections of the main division lines, such as at H, J, K. It is to be noted that this procedure has divided the major rectangles into smaller similar rectangles. In Figures 4 and 5 the large rectangles have been divided into still smaller rectangles.

Figure 6. This is just another way of deriving a Root 2 rectangle. Starting with the square ABCD and then using AB as a radius and A as a center, an arc is swung until it meets the diagonal AC at E. Through E a perpendicular line FG is drawn which forms the Root 2 rectangle ABFG.

Figure 7. In forming the golden rectangle, it is well to pay particular attention to its construction, as it is about the most pleasing rectangle that can be used. Start with a square FECD. Then draw the center line GH of the square. With G as a center and GE as a radius, describe an arc EA until it cuts the base line FD extended at A. ABCD is the golden rectangle. In Figure 8 the principal division lines are shown which are similar to those in Figure 2.

Figure 9. This Root 3 rectangle is used to show the method of deriving the reciprocals of the original rectangle. The diagonals and lines from the corners are drawn as previously explained. The lines AE and DG drawn from the corners at right angles to the diagonals, cut the outside boundary of the major rectangle at points E and G. From these points, perpendicular lines are dropped to the base. Thus is formed the reciprocals, or similar rectangles, ABEF and HGCD.

Figure 10. This is just another way of describing a Root 5 rectangle. Start with a square HGFI and find its center line EJ. With E as a center and EF as a radius, describe the semicircle AGFD. Points A and D, the intersecting points, determine the limits of the Root 5 rectangle.

After analysis of the foregoing principles the following conclusions as to space breaking may be drawn.

1. Diagonals of any area may be drawn, since diagonals break shapes into proportional areas.
2. New areas may be formed by constructing squares and root rectangles within the original area.
3. Angles may be bisected.
4. Draw lines between intersections.

Thus are obtained, naturally and logically, the principal areas that can be derived from the original area, and the designer is provided with a wide choice of points and spaces so that the individual taste is free to construct the skeleton of a design and its decorative subdivisions. The final results of this, if a proper amount of fine feeling is used, is a subtle and recognizable consistency. Truly logical interrelationship and the appearance of strength is the answer to all this. Dynamic symmetry furnishes the skeleton which is necessary in all good design, and which, if desired, may be carried into the most minute detail of the work.

With a *dynamic* shape, the designer can rest assured that he has a rectangle of correct proportions. The architect, writer, designer of fabrics, engineer, as well as the furniture designer, one and all are dependent upon a skeleton of some sort to execute their problems satisfactorily. Dynamic symmetry furnishes this skeleton.

Application

For this practical application a very simple cedar chest has been chosen.

The very first step is to make up a rough sketch of the particular piece that is to be constructed. (See Fig. 11.) Then proceed to lay out a dynamic rectangle that will approximate the proportions of the sketch and proceed as follows:

With a given height of 12 in., a rectangle, of an indeterminate length, is constructed. Starting with B as a center, and AB as a radius, the arc is described and a square formed and the process of obtaining a Root 4 rectangle is continued, as illustrated in Figure 1 in Supplement No. 173. This Root 4 rectangle is the

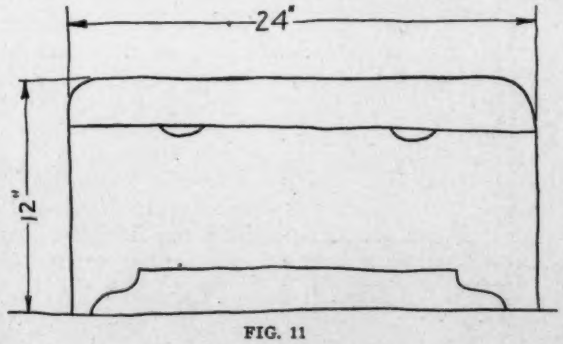

FIG. 11

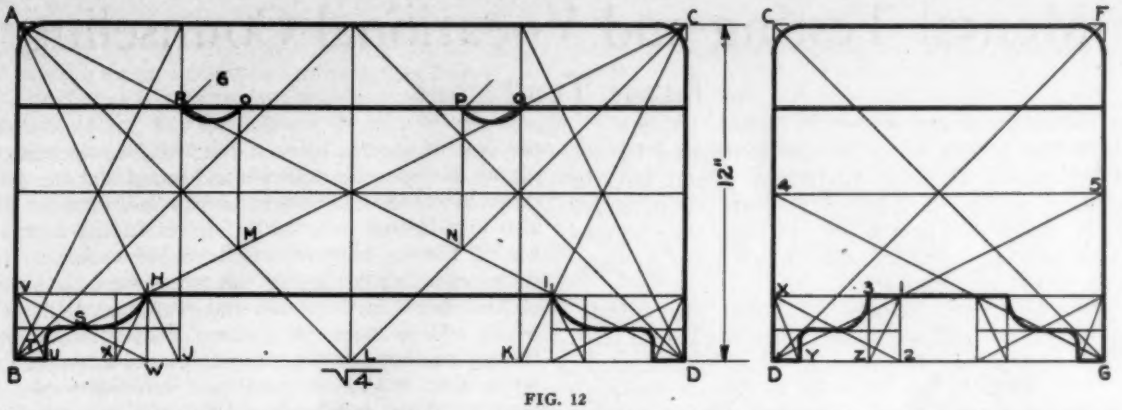

FIG. 12

nearest rectangle to the sketch of the chest as far as length and width are concerned. The diagonals AD (See Fig. 12) and BC are drawn next, and then the lines AJ and CK are drawn at right angles to the diagonals intersecting them at points H and I. Through H and I a line is drawn which determines the base space. Through points J and K perpendicular lines are erected which cut the diagonals at R and Q. Through these points a line is drawn determining the division between the lid and the body of the chest. We now have the three main divisions of the chest.

Now for the minor details of the chest, such as the legs and hand openings. Through points M and N, the intersections of the diagonals AL with BC and LC with AD, perpendiculars are erected until they meet the lid division lines at O and P. Thus is determined the width of the handle holes. For the construction of the legs a *similar* rectangle, BVHW, is drawn. Within this smaller but similar rectangle, *similar* lines are drawn, just as in the big rectangle. VW and BH are the diagonals, VU and HX are the lines at right angles to the diagonals. Here again points of contact or intersection are used.

The end view is just a repetition of the above procedure, the rectangle DCFG being half of the original rectangle ABCD, and, of course, in relation to it.

Bear in mind always the idea of repetition of rectangles similar to the parent area, that is, breaking up the parent area into smaller ones to suit individual needs.

Figures 13 and 14 show alternative designs which also have been worked out according to dynamic symmetry, thus showing the flexibility and freedom afforded by this system of design.

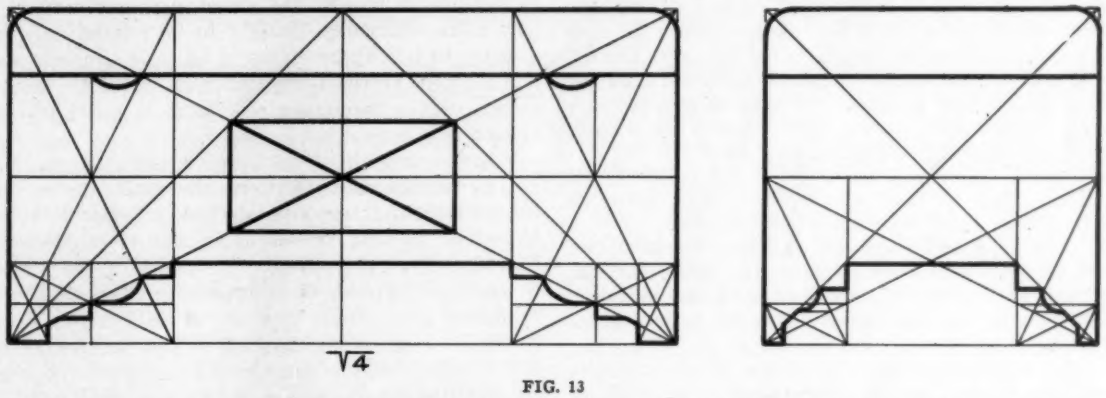

FIG. 13

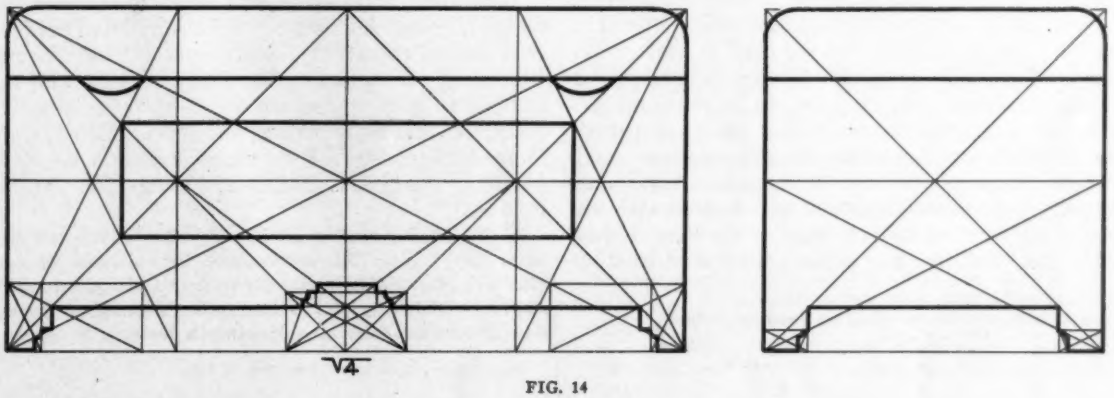

FIG. 14

Mental Testing and Vocational Counseling

*Payne Templeton**

AT the present time we are confronted by the problem, To what extent can mental tests be used in guiding high-school students vocationally? More specifically, how safely can these tests be used in the average secondary school which is not equipped with expert counselors?

John M. Brewer[1] includes in the term "mental tests" all tests of thought and feeling, even mechanical tests. The five types of "mental tests," listed by him, are:

1. The Aptitude Test. Examples of this are Stenquist's Mechanical Aptitude Test, Thurstone's Clerical Aptitude Test, Freyd's Journalism Aptitude Test. This type of measurement attempts to discover how well the subject is capable of doing in a given vocational field.

2. Trade Tests. This type differs from the first in that it attempts to measure what the subject knows about a certain field and what he can do at present. It is not so much concerned with what he may be capable of doing.

3. Character Tests. This field has hardly been touched by the "plowshares of science," but the pioneers are entering it, with promises of worth-while accomplishment in the near future. Already there are a few tests that may be used tentatively. What we call "character" is intimately affected by the emotions, the will, and attitudes, which will make the field a difficult one to explore. "It must be admitted that meager success has thus far met the attempts to measure will, emotion and attitude," says Mr. Frank Freeman.[2]

4. Definite Educational Tests, or tests of definite school experience. These are based on a period of actual instruction in school. Most standarized tests fall in this group.

5. Tests of General Fortuitous Experience. These are not based on a period of actual instruction in school. They are the so-called "intelligence" tests, both group and individual. The discussion here will be confined to this type of measurement.

What are the elements of one's general ability? More specifically, of one's vocational fitness? H. C. Morrison[3] states that a person's ability is composed of six elements: Physical-psychological, Physical-health, Emotional, Volitional, Experimental, Mental. The mental element is only one of the six, and perhaps not the most important. It will be easier and better to follow here the familiar classification used in discussing most things: physical, moral (emotional), and mental.

How much do physical qualities contribute to vocational success? A certain degree of health and vigor is essential to almost any accomplishment. Certain specific physical qualities are required in some vocations — strength in a manual laborer, dexterity in a tradesman, comeliness, perhaps, in a stenographer. Most physical qualities are rather easily measured, except for a few rather subtle physical qualities.

Moral characteristics are tremendously important, naturally — just how important as compared with the mental we have no definite way of knowing. Fryer[4] states that emotional and moral ability is at least 40 per cent of general success. John M. Brewer made a survey of engineering failures and found that the most common cause is failure in human relationships. He also investigated over 4,000 failures in the business world. Eleven hundred of these were due to incompetence, while most of the others were the result of weaknesses in the moral and emotional field. In a recent address before a teachers' convention, a psychology professor at a western university attempted to prove that ninety of every one hundred cases of teacher failure can be traced to emotional troubles. Seldom is failure due to lack of intellect or professional training, he contends. Little headway has yet been made in the objective measurement of moral and emotional qualities.

Finally, there are the mental requirements for vocational fitness. High mentality and character often go together, but not always, or necessarily. To quote Freeman again: "It was thought for a time that deficiency in intelligence was a chief cause in misconduct. It is now more commonly thought to be related only indirectly to it." There seems to be little demonstrable relationship between mental and physical ability, except that a minimum of health is necessary for almost any mental achievement.

What is "mentality," or "intelligence"? (Distinctions are sometimes made between the two, but we will think of them as synonymous here.) Lester F. Ward has given us that famous definition of intelligence: "Intellect plus knowledge." Some call it the ability to learn and to profit from experience. Stern says, "Intelligence is a general capacity of an individual consciously to adjust his thinking to new requirements." Native intelligence is considered by some as a constant nucleus that obtains to the same degree in all manifestations of ability. Others believe that one's native intelligence is a variant, depending upon aptitudes and special abilities. This controversy is not yet settled, but the first viewpoint seems to have the edge at present.

It is well to make a theoretical distinction between the two kinds of intelligence, native and acquired. But since it seems at present impossible to measure the native quality, we will give intelligence the ordinary meaning here, "Intellect plus knowledge."

Thorndike classifies intelligence as mechanical, social, and abstract. There is some correlation between each pair of these, but probably not a great amount. We know, for instance, that many persons who are brilliant in their studies are not effective socially. We know, too, that many persons who are considered bright in academic classes are not superior when it comes to handling machinery. Stenquist[5] brings this out as follows:

> As a matter of fact, it seems clear that intelligence may be of many kinds. Thus, for example, the campaign manager exhibits a quality differing sharply from that of the locomotive engineer; while the kind of intelligence required to lay out the construction work of a Woolworth Building is not very

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[1] *Mental Measurements in Educational and Vocational Guidance.*
[2] *N.E.A. Journal*, February, 1928.
[3] *The Practice of Teaching in the Secondary School.*
[4] *School and Society*, September, 1922.
[5] *The Principles of Secondary Education*, p. 315.

like that needed to write a forceful letter, and this, in turn, is not very like that employed in painting a great picture, or inventing a great machine such as the modern linotype.

Intelligence is a factor in vocational success, an important factor, beyond a doubt. It may be the most important factor of all. If only we could accurately measure intelligence, how completely and delightfully the vocational and industrial life of the world would be revolutionized!

What does the *intelligence test measure?* Does it measure native mental ability? Only indirectly, of course, since what one is, is due both to nature and nurture. Mr. Bagley[6] puts it this way:

The tests measure a certain ability or group of abilities, but the contributions of experience become so numerous and influential and these vary so widely even among individuals of fairly homogeneous groups that it is the height of absurdity to contend that it is a native and unmodified factor that is being measured.

But the native quality is indicated through measurement of acquired ability. One who is naturally bright will learn and accumulate more than one lacking in native intelligence.

The intelligence test seems to measure abstract, verbal, academic ability only; that is, to any accurate degree. It tests "mental agility." Henmon[7] states this fact as follows:

The so-called general intelligence tests are not general intelligence tests at all but tests of the special intelligence upon which the school puts a premium. We have been gradually evolving a type of test for abstract intellect that is of use in classification and prognosis in school, but it is of no convincing value as a measure of general intelligence as such, nor of demonstrated value in vocational guidance and direction.

That the intelligence test measures academic ability rather well seems adequately established. It is an invaluable aid to educational guidance, and, insofar as the vocational is related to the academic, to vocational guidance as well. There has been some controversy as to the constancy of the I.Q. Most of the evidence indicates that the I.Q. remains reasonably constant. This would be only natural, inasmuch as the same type of test is given each time.

What does the intelligence test fail to measure? Naturally it gives little indication of physical ability. It cannot give us adequate information regarding moral and emotional qualities. It can hardly give any evidence of interest, and interest is a very important element in vocational guidance. Says Brewer: "Though there may often exist interest without ability, or a moderate amount of skill without interest, there should be a coincidence of ability and interests before definite choice of vocation is made."

The intelligence test is hardly a satisfactory measure of the type of intelligence called "social" by Thorndike, the ability to get along with one's fellows or to master men. Nor can it help much in deciding how much mechanical intelligence the student has. As discussed above, it tests native ability, but only indirectly.

Nor does it adequately gauge specific mental abilities and aptitudes. These are more important than so-called general intelligence, some authorities think, though this is still a moot question. Here is Edgerton's view:[8]

[6] *School and Society*, April 8, 1922.
[7] *Journal of Educational Psychology*, April, 1921.
[8] *Vocational Guidance and Counseling.*

Consequently special abilities are far more significant as factors in vocational counseling than are general intelligence levels.

Viteles[9] states:

The factors which determine vocational competency are the individual specific mental abilities. For positive guidance the specific abilities of importance in the various occupations must be subjected to measurement.

Are there intelligence levels in occupations? Within rough limits, yes. During the world war considerable work was done along this line. Something was discovered which everybody knew generally before; namely, that the average intelligence of the workers in some vocations is higher than in others. Fryer[10] gives a list of the relative ratings of the occupations. Here are some typical scores: 161 Engineer (Civil and Mechanical), 152 Clergyman, 137 Accountant, 127 Physician, 122 Teacher (Public Schools), 110 Dentist, 103 Stenographer and Typist, 65 Tailor, 63 Machinist (General), 63 Brakeman (Railroad), 62 Actor (Vaudeville), 60 Carpenter (General), 35 Lumberman, 32 Sailor, 27 Cook, 26 Textile Worker, 20 Fisherman. You will notice that the fisherman comes last on the list, which is a considerable blow to some of us in the west who boast of our achievements along that line. There are limitations to the value of getting the I.Q. of occupations. Viteles[11] brings this out clearly:

Examination of the occupational intelligence standards of the army reveals the fact that no trade is unique in the sense of monopolizing any one level of intelligence. Instead, "average intelligence" is "sufficient" in the sense of being a minimum entrance requirement to probably three fourths of the occupations of industry.

Besides, these levels indicate what *is* the situation, not what it *should* be. Perhaps a higher type of intelligence is needed in some of these vocations which are not patronized by the more brilliant. Says Proctor[12] on this point:

There is room for superior intelligence in every occupation, and it would be well for the country if young people of superior ability were encouraged to follow agricultural, mechanical, and industrial pursuits, in order that they might become leaders therein. The professions are overcrowded, but there is always room for young people with ideas and energy in the food-producing and industrially creative occupations.

Can intelligence tests, then, be used to guide young people into occupations? "Most assuredly," answers the extreme left. "They are being used and will be used more and more to place people into their proper vocational niches." The following is quoted from an article by John Monk Saunders:[13]

Do you know that the psychologists are analyzing human beings as a chemist would analyze a phial of some unknown substance? You can present yourself at any one of fifty testing stations over the country for a test which will tell you how you rate mentally with millions of other people in the United States. The purpose of it all is to help you find the work you want to do and are most fitted for. . . . The great value in giving intelligence tests to clerical workers is that it takes the misfits out of positions that don't suit them and places the alert ones in the busy corners, and rearranges the force according to an almost exact science of ability. . . . Can you actually predict what a person can do in life? . . .

[9] *School and Society*, September 19, 1925.
[10] *School and Society*, September 22, 1922.
[11] *School and Society*, September 19, 1925.
[12] *Psychological Tests and Guidance.*
[13] "Mental Tests Can Tell You What You Are Fitted to Do," *American Magazine*, December, 1924.

Pretty closely; that is, if a young man should present himself at one of the testing stations we could discover after a test, his qualities, such as quickness of thinking, accuracy of thinking, and ability to learn. We could then tell him whether he would do well in professional life as compared with engineering or mechanics; but we would hesitate to say whether he should choose medicine or law. We would tell him he would do well in either. . . . But we're getting away from guesswork and we'll soon be able to give as accurate analysis of ability and character as a physician can of the blood and organs.

Perhaps it is only fair to state that the tests here are individual and are given by men supposed to be expert.

It seems that some interesting work along this line has been done recently in Germany. Here is a quotation from an article in *School Life*, (1927), entitled "Vocational Guidance by German Municipal Institutes": "Tests, given in the institute, are usually very simple, the more complicated forms having been abandoned. Though the general character of tests has been standardized, details are changed frequently. In Cologne the written part of the test includes (1) a 10-minute essay on the applicant's choice of a career, (2) missing word test, and (3) completion of unfinished paragraphs. Manual and sensory tests include (1) manual strength, (2) color selection, (3) visual measurement, and (4) manual tests to determine dexterity, tempo, exactitude, ability to reproduce, etc. Tests can be completed in about two hours. Their principal value is said to be in the opportunity given for observation of the candidate during the test. . . . Voluntary guidance of this character, in the opinion of the correspondent of the London *Times* who described the system, is meeting with ever-increasing support of employers. In Cologne students in medicine, law, architecture, and music, are availing themselves of the services of the institute for psychological tests, indicating that the system is applicable also to the professions in assisting in the choice of a career." It will be noticed that the psychological test described here is an individual one, and that it includes activities not ordinarily found in the intelligence test.

Then there is the more conservative view that testing for vocational guidance should be done, but only by experts. The ordinary school principal or teacher had better keep hands off, according to this viewpoint. Viteles expresses this belief: "But to say that a subject is incompetent for one specific vocation and competent for another simply because he has an I.Q. of 75 in one or another of the so-called individual or group tests of general intelligence verges on the absurd. The simplicity of using a single index of mental measurement, which can be obtained so readily, enhanced the popular value of the so-called test of general intelligence; its very simplicity suggest cautious use to the scientific workers impressed with the extreme complexity of the problem of analyzing human personality. . . . It follows from the foregoing discussion that for dependable results in guidance, tests must be applied by trained personnel. In all cases the interpretation of tests results, for purposes of guidance, can be made only by the clinical psychologist."

Then we have those on the extreme pessimistic right, represented by H. L. Miller and to some extent by Bagley. "Let us not even think of using the intelligence test in guiding children vocationally," is their view, "nothing could be less democratic and more dangerous." But let Mr. Miller[14] express himself:

> A democratic order of society cannot remain democratic and tolerate any form of guidance which is predetermining in character and which originates in and is conditioned by any agency or authority outside the individual. . . . It follows, therefore, that any program of guidance to serve democratic ends must avoid determinism of every sort and follow the ideal of self-completion. . . . In the case of human potentiality it is not revealed to anyone what particular opportunity will develop the highest and surest release of developing powers. . . . Wholly adventitious circumstances sometimes act as social encouragers by imposing unanticipated responsibilities on the individual, and as a result genius grows in unexpected quarters — a fact confirmed both by observation and biography.

As on all questions, we have here the middle-grounders, who hold that the intelligence test can be used by school officers for purposes of general vocational guidance, but not to guide pupils into definite vocations. It can be used to advise them regarding five or ten classes of vocations: Unskilled labor, semiskilled labor, skilled labor, clerical and business fields, the professions, etc. The boy with a rather constant I.Q. of 90 can be advised, though not too insistently, to stay away from the professional and technical callings. While the boy with a constant I.Q. of 130 can be pushed almost to the limit vocationally. Does this view imply that the student is told his intelligence score? If so, is this a dangerous practice? Says H. C. Morrison: "When we raise questions touching inherent ability, we attack the very citadel of personality." Needless to say, this middle-ground viewpoint has the majority with it.

Too, there is the stand that tests should be used to increase, but not to decrease, vocational opportunities. All encouragement would be positive. A student would never be told what to avoid. His high score in the intelligence test would be used to spur him on to the limit of his vocational ability. Just the opposite view is expressed by Proctor: "The employment of psychological tests as an aid to vocational guidance is in the early experimental stage, but sufficient progress has been made to justify their use in a negative way, i.e., as a means of discovering to the counselor the kinds of occupations that a given high-school pupil would probably better avoid." We know that there is undoubtedly a waste of genius and ability, that many people are in vocations which do not fully try them out. But on the other hand, there is room for superior intelligence in almost any occupation.

It seems impossible to make a dogmatic answer to our questions: To what extent can the intelligence test be used in vocational guidance? Is it safest to avoid the extremes and agree with the middle-grounders? Possibly this would be the best for the average counselor in the average school. Or should we be even more conservative and use the intelligence test only to increase opportunities, as a prod to the brilliant? Or should we give up this possibility because it would mean telling the subject his intelligence score? Perhaps the average counselor in the average high school should not at present use the intelligence test at all. This is indicated by Edgerton: "Because of the difficulty experienced in developing aptitude and intelligence tests,

[14] *The Self-Directed School.*

perhaps we should lessen the emphasis upon tests, at least temporarily, and place more emphasis upon the scientific analysis of the occupations until it has reached a stage or level equal to that of the tests."

It is the personal view of the writer that the average schoolman should be very wary indeed. Guiding young people into definite vocational fields is dangerous, even with a wealth of data. He certainly should not use the intelligence test to any considerable degree in guiding young people into a specific vocation. But it is equally foolish for the schoolman to be prejudiced against the intelligence test because he doesn't quite understand it. It adds something to the data on a case. It gives the schoolman a kind of evidence he will not get so accurately in any other way. And he should remember always that these pioneer scientists in the field of intelligence are making progress, and that some day, not far distant, they may make mankind their eternal debtors by cutting down appreciably the present lamentable vocational waste.

Aviation in Secondary Schools

*Andrew Roswall**

PART II

AT the present time there is perhaps no field that offers more opportunities of employment and better prospects of advancement than that of aeromechanics with commercial transport companies. For this reason the government, through the Department of Commerce, offers every assistance and coöperation to schools who undertake to train young men for this important branch of aviation.

The government will practically assist in every detail, except furnishing building and equipment for this kind of education.

The most important part to consider is the location of hangar and workshop for the school; the larger the space that can be obtained the better. The foundation for the hangar now under construction in the Boston Trade School, is 35 by 105 feet. This will take care of three average-size planes.

Various types of hangars are used by transport companies. These are made of steel, wood, or brick. Steel hangars are the least expensive to erect, but it is almost impossible to heat them in winter and they are unbearably hot in the summer. They are therefore unsuitable for schoolwork. The most satisfactory type is a combination of steel and hollow-tile building with a wood roof, covered with tar paper or shingles.

Due to the necessity of having unusually large doors to admit or remove planes, doors or metal curtains that move up or down vertically, have been found most satisfactory.

The shop activities that are encountered in the repairing of planes, such as woodwork, sheet-metal work, machine work and welding, may be carried on in existing shops, but this is not as satisfactory as where a separate shop adjoining the hangar is provided.

Methods of construction and materials used in the manufacture of airplanes are constantly being changed. First of all, wood planes with fabric coverings for wings, fuselage and control surfaces, were in vogue. Later the all-metal plane, riveted and welded together with not an ounce of wood in it, came into existence. At present airplanes are built with wings and control surfaces of wood, and metal fuselages covered with fabric or three-ply veneers.

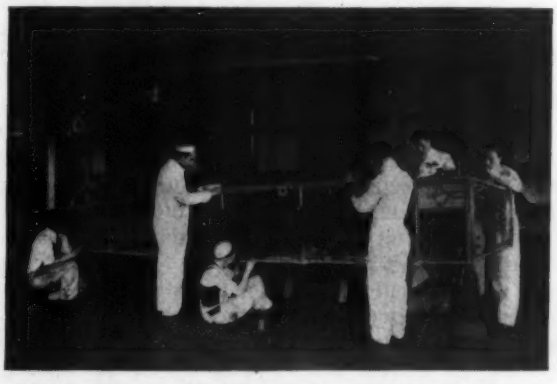
It is evident, therefore, that the shop must be equipped to do woodwork, sheet-metal work, welding, doping and painting, and have a commodious stock and toolroom. The simplest tools and machinery are used, so that a thousand dollars will suffice to pay for the tools and machines required by a class of twenty students.

In working out the course of study, the writer has had the assistance of many men familiar with the problems involved. The course was made to apply to two separate groups, namely, *mechanics*, who are trained on plane and controls, and *engine mechanics*, who are trained on the motor and its accessories. The first group has to do with the repair and maintenance of wings, fuselage, empennage controls and landing gears, setting up and adjusting of controls and wires, and final checking up and inspection.

The second group is trained on motors, instruments, radiators, tanks and power-plant operation and repairs. All training for manipulative skill is given on aircrafts furnished by the United States Government as provided by an act of Congress.

Related work is carried on simultaneously with the shopwork. This is done in separate classrooms, and covers mathematics, science (physics and chemistry), drawing, trade processes, history, and geography.

The students of the first group mentioned in the foregoing, are drawn from cabinetmaking, sheet-metal, and welding classes, having already been trained in these trades for at least two years. The students for the second group are drawn from the electrical, machine,



SEWING FABRIC ON FUSELAGE OF N.Y.2 NAVY PLANE FOR U. S. NAVY DEPARTMENT. BOSTON TRADE SCHOOL

*Boston Trade School, Boston, Massachusetts.

and automobile departments, where they also have been receiving training for at least two years.

The two groups, *mechanics* and *engine mechanics*, are distinct in their training, and members of each group are awarded different diplomas. To qualify for these courses it is necessary for a student to have completed a two-year course in one of the aforementioned departments, and to have established a record for reliability as well as for a certain attainment of skill.

Students in other departments related to those mentioned may be admitted to the airplane department, if they have proved themselves well prepared for the work.

A foundation in cabinetwork or automobile repair should be the preliminary training for ground mechanics in aviation.

Course for Mechanics

All courses in the Boston Trade School extend over a period of four years, forty weeks a year, ten periods a day of forty minutes' duration each, and five days a week. Accordingly, the course for airplane mechanics is arranged to require one thousand periods a year in the shop, and the same amount of time on academic and related subjects.

The completion of two years of work in the aforementioned departments, enables the students to handle tools, operate machines, and do creditable work in any of the trade activities that are required in the repair of aircrafts.

The third year is divided as follows:

	Periods
Shopwork (sheet metal and welding, parts of planes)	1000
Drawing	240
Mathematics	120
Science (physics and chemistry)	200
Trade Processes	120
English	120
History and Geography	80
Study	40
Drill and Gymnastics	40
Hall Assembly	40
Total	2000

The fourth year is also equally divided between academic and shopwork, and the general program is very much as it was in the third year.

The shopwork consists of replacing parts of wood, metal, fabric, or wire, on any or all parts of a plane. Painting, welding, and splicing also are included. Then come assembling and adjusting of the plane and its controls, and finally the inspection and checking up of the complete ship before its flight.

Course in Engine Mechanics

The time allotment to each study in *engine mechanics* is the same as in the *mechanics* department. All subjects, however, are related to the engine, power plant, and instruments used on an airplane. The shopwork for the third year consists of the following units: theory and principle of the four-cycle motor, the principle and operation of a gas engine, aircraft-engine terms, comparison of the automotive and airplane engine, valves and valve timing, lubrication and cooling, oil temperature, oil pumping, carbon deposits, radiators, rust and corrosion, the repairing and assembling of various types of "V" and "Radial"

MOTOR WORK ON J.4, J.5, AND HISPANO MOTORS FOR U. S. NAVY DEPARTMENT

Note J.5 in center has been replaced on ship and is now in Service, Airplane Station, Squantum, Massachusetts. Boston Trade School.

motors, and the installation of the power plant in airplanes.

The fourth-year shopwork includes the study, repair, assembling, and adjusting of Zenith and Stromberg airplane duplex carburetors; repair, assembling, testing and timing of airplane magnetos and other ignition systems; adjustment, care and maintenance of airplane starters, generators, and storage batteries; detailed study of the symptoms and remedies of the various troubles which may arise in an airplane power plant; and the final testing and adjustment of the engine before flight; and the repair of airplane instruments and accessories.

Related subjects are given the same amount of time as in the third year; namely, 1000 periods.

The foregoing course of study in its complete form, including division of operations into units, and units into lessons, was submitted to The Daniel Guggenheim Foundation for the Promotion of Aeronautics, 598 Madison Avenue, New York City, for their comments or approval. This organization thought well enough of the course to publish it, and it may be obtained without cost from them by schools interested in starting courses in aviation.

STABILITY

Flash powder makes a brilliant light, but you can't use it to light your street corner because it doesn't last long. Stability is more essential to success than brilliancy.—*R. L. Jones.*

LEARNING AND LABOR

Whatever may be the ultimate compound of concerns of our educational enterprise, we cannot, civilization trends being what they are, divorce learning and labor — separate the training of the man and his job, especially in this day when it has become altogether too easy to separate the job from the man. Has not the youth today — utilizing education to become physician or poultry man, bacteriologist or butcher, teacher or toolmaker, mineralogist or machinist, engineer or engraver, lawyer or linotypist — the right to a scientific forecast of his opportunities to correlate training and career? Education as a whole should possess conclusions covering the whole of the diverse range of human work.—*Edward C. Elliot, President, Purdue University.*

Industrial Testing in School

*Arnold Levitas**

IT is not an easy matter to determine just what standards or qualifications should be set for a given trade. Nor is it easy to say how the existence of these qualifications in a particular individual are to be determined. Some attempts have been made along this line, however, and the following are some suggestions of how to proceed to determine a student's aptitude for the printing trade.

When the boy enters the trade school for the first time, it would be well to give him a general test consisting of a number of questions pertaining to the various branches of the printing industry. These questions might be arranged in the manner of a multiple-choice test. If a hundred such questions were used, it might be possible to get a fair idea of the candidate's conception of the subject. Such a general test follows.

General Test

Directions: Draw a line through the word or words which makes the best sense in the following statements.

1. Setting type pertains to (*a*) binding (*b*) printing (*c*) electrotyping (*d*) engraving.
2. A composing stick is made of (*a*) wood (*b*) iron (*c*) steel (*d*) bronze.
3. To set type, use a (*a*) key (*b*) galley (*c*) ruler (*d*) composing stick.
4. Type composition costs most when it is set by (*a*) hand (*b*) linotype (*c*) monotype (*d*) mixed.
5. If there are 72 points to the inch, 2½ inches will contain (*a*) 144 points (*b*) 216 points (*c*) 180 points (*d*) 192 points.
6. For setting an advertisement, we need a (*a*) linotype (*b*) monotype (*c*) composing stick (*d*) type caster.
7. For setting the straight-matter type of a 320-page book, we need a (*a*) composing stick (*b*) typesetting machine (*c*) pressmen (*d*) operators.
9. The straight-matter type on a magazine is set by (*a*) hand compositors, (*b*) machine operators (*c*) distributors (*d*) stonemen.
10. Distribution of display type is done by the (*a*) compositor (*b*) distributor (*c*) stoneman (*d*) make-up man.
11. Making up the pages of a book is done by the (*a*) stoneman (*b*) compositor (*c*) make-up man (*d*) distributor.
12. To set a letterhead, we need (*a*) old-style type (*b*) modern type (*c*) Gothic type (*d*) display type.
13. Setting a church program, we need, for emphasis (*a*) Gothic type (*b*) text type (*c*) old-style type (*d*) italic type.
14. For setting the reading matter of a magazine, we need (*a*) old style type (*b*) Gothic type (*c*) text type (*d*) italic type.
15. For setting the captions under illustrations, we usually need (*a*) text type (*b*) Gothic type (*c*) light-face type (*d*) bold-face type.
16. A job of hand composition is corrected by (*a*) operator (*b*) proofreader (*c*) reviser (*d*) compositor
17. A galley proof of a job is pulled by the (*a*) proofreader (*b*) compositor (*c*) pressman (*d*) stoneman.
18. The compositor, in tying up pages, uses (*a*) wire (*b*) cord (*c*) catgut (*d*) yarn.
19. A type gauge is used for (*a*) locking up a job (*b*) planing down a job (*c*) measuring type (*d*) distributing type.
20. Tweezers are used for (*a*) correcting type matter (*b*) setting type (*c*) distributing (*d*) locking up job.
21. A type case is used for (*a*) linotype slugs (*b*) hand type (*c*) electrotypes (*d*) stereotypes.
22. Type spaces are used (*a*) between words (*b*) between paragraphs (*c*) between lines (*d*) between chapters.
23. Leads are used for spacing between (*a*) lines (*b*) words (*c*) sentences (*d*) chapters.
24. Slugs are used for spacing between (*a*) straight-matter lines (*b*) words (*c*) display lines (*d*) sentences.
25. Distributing type means (*a*) throwing it away (*b*) putting it back in the proper place (*c*) melting it over (*d*) recasting it.
26. For distributing type, one uses the (*a*) composing stick (*b*) tweezers (*c*) fingers (*d*) ruler.
27. Each compartment in the type case stores (*a*) letter or character (*b*) several letters (*c*) word (*d*) figure.
28. The case is arranged in (*a*) alphabetical order (*b*) numerical order (*c*) in haphazard fashion (*d*) in accordance with a system.
29. The most-used letter in the type case is (*a*) e (*b*) b (*c*) k (*d*) m.
30. Letters in the type case frequently used are (*a*) b, j, k, l (*b*) m, n, c, t (*c*) p, q, y, w (*d*) x, z, f, v.
31. Letters in the case which are used very little are (*a*) k, x, v, q (*b*) m, u, c, d (*c*) p, l, f, g (*d*) c, e, h, i.
32. A letterhead is set by the (*a*) linotype operator (*b*) monotype operator (*c*) hand compositor (*d*) stoneman.
33. Straight-matter composition is measured by the (*a*) square inch (*b*) thousand ems (*c*) hour (*d*) line.
34. The depth of type is based on (*a*) points (*b*) inches (*c*) picas (*d*) ems.
35. The thickness of printing material is based on (*a*) inches (*b*) picas (*c*) points (*d*) ems.

Since the general test contains questions on the various branches of the printing industry, it is possible to learn just what particular the candidate knows about each branch in a general way. But every branch of the printing trade has its peculiar characteristics as well, and would require certain special abilities or inclinations on the part of the person who is desirous to succeed in it.

There are quite a number of branches in that trade; but, for our purposes, we shall consider five of these branches — those most popularly sought. Each one of these five requires certain distinct qualifications, and tests may be provided to determine the existence or nonexistence of these aptitudes in the candidate.

The following outline will show the requirements in the five branches in question:

Special Tests

1. *The Job Compositor*
   - *a*) Spelling Test
     - Spelling
     - Word formation
     - Word endings
   - *b*) Typographical Test
     - Typographical taste
     - Interpreting type
   - *c*) Typographical Intelligence
     - Typographical information
     - Typographical understanding
2. *The Linotype and Monotype Operators*
   - *a*) Mechanical Test
     - Knowledge of machinery

*Newark, New Jersey.

Mechanical intelligence
b) Spelling Test
Spelling
Word formation
Word endings
3. *Proofreader*
a) Spelling Test
Spelling
Word formation
Word endings
b) English Test
Construction of sentence
Meaning of words
c) Book-Knowledge Test
Books
Authors
d) Proofreading Test
Ability for finding mistakes
Ability to edit copy
4. *The Stoneman*
a) Mechanical Test
Mechanical intelligence
b) Mathematical Ability
Ability with figures
Perception
5. *Pressman*
a) Mechanical Test
Knowledge of machinery
Mechanical intelligence
b) Patience Test
Feeding on press
c) Industry
Liking for the work
Application for the work

A few typical special tests follow:

Spelling Test

For Job Compositors, Linotype and Monotype Operators, and Proofreaders.

Spelling, Word Formation, and Word Endings.

In answering questions, use only the number of the question. Do not repeat questions on your paper.

1. Write the plurals of the following words:

Illustration
chair — chairs
church — churches
man — men.

table	fish	grouse
box	foot	Chinese
motto	boot	Japanese
potato	corn	crisis
three and four	German	datum
leaf	Frenchman	genius
knife	Englishman	genus
army	woman	
lady	deer	

2. Write the past tense for the following words:

Illustration
speak — spoke
find — found
prepare — prepared.

go	catch	choose	drink
talk	bring	can	give
say	stay	pray	take
ask	lie	sit	make
do	stand	create	need
play	write	eat	play

3. Write these words with as many endings as you can think of:

Illustration
do — does, doing
plan — plans, planning
try — tries, trying

speak	benefit	clan	control
finds	not	bag	travel
ask	beg	bride	transfer
forget	due	sale	infer
remember	prefer	profit	abridge
explain	brief	kidnap	begin

Test for Typographical Intelligence

For the Job Compositor.

Test for Typographical Knowledge and Information.

Do not repeat question with your answer. Use only the number on your paper.

Illustration
Question:
1. Where would you use the plain light-face type?
Answer:
I would use plain light-face type for books, magazines, and newspapers.
2. Where would you use bold-face type?
3. When would you use italic type?
4. What kind of type would be proper for a business card?
5. What kind of type would be advisable for an advertisement of soap?
6. What kind of type would you use for an advertisement of agricultural implements?
7. Make a design of a simple business card 2 by 3½ in., using the following copy:

Telephone, Worth 3417
Oswald Publishing Co.
314 Broadway
New York City
Davis Smith, Representative

8. Make a design of a letterhead, 2¾ by 8½ in., using the copy above.
9. What kind of type do you think is advisable to use on a book of fiction?
10. Make a design of an advertisement, 3 by 5 in., using the following copy:

PRATT HATS
The Finest Hats Made in America
There are 317 Pratt Hat Stores scattered throughout the United States and Canada. You will find one near where you live. If not, write us, and we will send you the hat you want.
Pratt Hat Company, Inc.

New York	Boston	Philadelphia	Chicago
Providence	Milwaukee		St. Louis

English Test

For the Proofreader.

Test for the Meaning of Words and Construction of Sentences.

1. Write one or more similar words for each one of the words given in the copy below. Do not repeat the question. Write only the number in answering your question.

Illustration
take — receive, accept
pretty — beautiful, handsome
great — large, big, grand

anger	price	always	joke
sincerity	repair	purchase	help
guess	dislike	occupations	house
start	support	praise	joy
answer	entertain	arrange	polite
ruin	fine	regard	reward

2. Write the *meaning* of each of the following words — showing how the meaning changes with a slight change in spelling. Separate each pair of words. Do not repeat the question. Write only the number in answering your question.

Illustration

bread — food to eat
bred — born
bough, bow
bad, bade
berth, birth
canvas, canvass
cellar, seller
cruise, crews
coarse, course
fair, fare
guilt, gilt
herd, heard
air — the atmosphere
heir — one who inherits
hoarse, horse
might, mite
ore, or
peace, piece
plain, plane
principal, principle
stile, style
series, serious
waste, waist

3. Make a sentence with each one of the following words. Do not repeat the question. Write only the number in answering your question.

Illustration

take — I shall take the book home.
reply — My reply was very brief.

when	give	each
always	prepare	pretty
finish	costly	final
opportunity	economy	unusual
ideal	business	thoroughly
protected	unless	advantage
unprepared	circumstances	

4. Write a sentence with the following words in the past tense.

Illustration

find (found) — I found my pencil.
give (gave) — They gave us bread and milk.

take	walk	sit	allow
eat	fly	talk	pray
learn	sleep	ride	find
plan	teach	sing	stand
stay	beg	rest	speak
bring	try	answer	throw

Mathematical Test

For the Stoneman.

Test for Ability with Figures and for Perception.

Do not repeat the question. Write the number of the question on your paper only. Show how you get your answer.

1. There are 72 points to the inch. How many inches are contained in 396 points?

Illustration

1. 396 pts. ÷ 72 pts. = 5½ in.
Answer — 5½ inches

2. The inch consists of 6 picas. How many picas are there in 17¼ inches?
3. How many points in 14 picas?
4. How many picas in 396 points?
5. How many points in 7½ inches?
6. Every square inch consists of 36 pica ems. How many pica ems in 16 square inches?
7. A page is 3 inches wide and 5 inches deep. How many square inches in the page?
8. How many picas in a page 3 inches wide by 5 inches deep?
9. How many pica ems in a page 4 inches wide by 6 inches deep?
10. How many pica ems in a page 5 inches wide by 7 inches deep?
11. How many pica ems in a page 3½ inches by 5½ inches?
12. How many pica ems in a page 4¼ inches by 6¼ inches?
13. From a sheet of paper 25 inches by 38 inches, we can get 16 pages. How many sheets would be required for a book of 320 pages?
14. One sheet of paper, 25 inches by 38 inches, will allow 12 pages to be printed. How many sheets would be required for a book of 416 pages?
15. How many sheets of 25 inches by 38 inches would be required for a book 376 pages when each sheet will allow 24 pages to be printed?

RETRAINING OUR PEOPLE

Laurence Parker, Pittsburg, Kansas

In a world that moves as fast as ours does today, we need vocational evening classes in order that we can keep up and keep posted on our jobs.

The old-fashioned stage hand or scene shifter at "The Majestic" is succeeded by the man who can be counted on to make "talkies" talk.

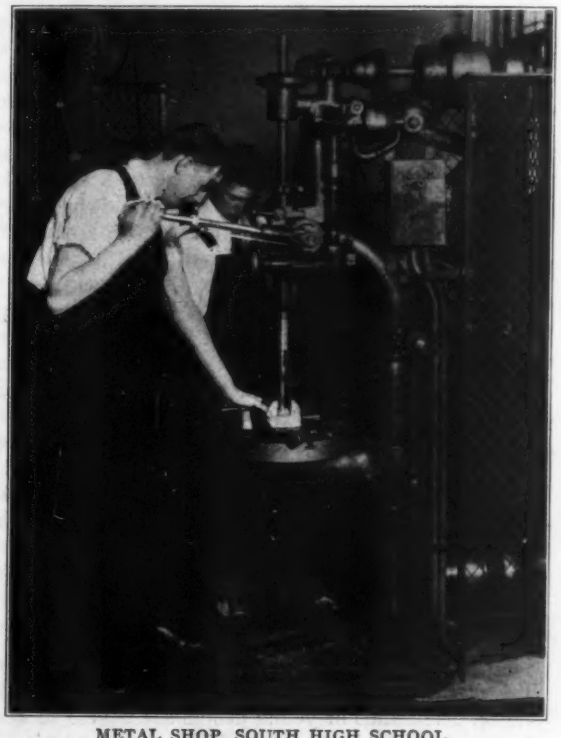
Phonographs are succeeded by radio, and the simple radio of yesterday by the marvelous one of today, while just around the corner is television. Men must be trained to build and service them.

Wagon shops and harness shops are moving off Main Street and lay off their help, while automobile row requires mechanics, painters, and upholsterers.

The artificial ice plant requires less help in the plant and on the service trucks, while more men are needed to make and to service electric and gas refrigerators in homes.

Almost before the last livery stable closed in one town of 10,000 people, $100,000 had been spent on a municipal airport and soon men now working as auto mechanics will be needed as airplane mechanics.

In the cases cited and in thousands of other instances, men and women need completely new or partially new training in order to carry on their share of the world's work and incidentally be worth more. It is here that the vocational evening school must step in and welcome these people. In the small classes made up of other workers at the new trades, the student learns the things that he must know in order to make his job secure, and his work profitable to himself and to his employer.



METAL SHOP, SOUTH HIGH SCHOOL, DENVER, COLORADO

INDUSTRIAL-ARTS MAGAZINE

J. J. METZ, Editor

THE CULTURAL AND VOCATIONAL IN PUBLIC EDUCATION

There are those in the field of popular education who exalt the cultural side, and decry the vocational. They usually succeed in making out a plausible case, but when all is said and done the practical American mind fixes a reasonable estimate upon both the cultural and vocational side of things. Each has its place in a well-planned curriculum. That the cultural and vocational must be fostered simultaneously is obvious.

But just as one schoolmaster may enlarge to the extreme upon the cultural studies, another may overemphasize the vocational. The fact remains that the fundamentals cannot and must not be ignored. The complaint is frequently heard that the young recruit in factory or office has failed in the rudiments of a common-school education. He may read a blue print but be off on his arithmetic, or he may know how to hammer a typewriter but be weak in spelling.

In a recent United States Government report, George H. Carter, the public printer, says that during the years 1922–1929, the number of applicants for apprentices in the government offices was 1,792. Out of this number 821 failed to pass the civil service examinations because they were deficient in spelling, grammar, reading, writing, and arithmetic. The examinations call for 70 points on mental tests and only 30 points on mental aptitude. Mr. Carter further says:

"Training of apprentices convinced me that the American youth needs a much better education than he now gets for employment at the printing trade. The common schools seem to be failing to give our boys and girls the fundamentals of an education that will help them through life. Teaching of the 'three R's' appears to have become an abandoned art and has been replaced by a lot of fads and follies which apparently are interesting to the teacher but of little practical value to the pupil."

The modern vocational school recognizes the criticism advanced in the foregoing. In fact, the origin, growth, and development of vocational training, as exemplified in this country today, rest upon that recognition. If the modern vocational school has superseded the old-time apprentice system to a large extent, it is because the study of the fundamentals travel side by side with the acquisition of manual skills. In brief, the cultural studies are fostered as a necessary part of the vocational.

UNEMPLOYMENT

The wave of unemployment which is at present sweeping over the entire country, is a challenge to the school. Thousands of young people are unable to keep themselves occupied gainfully. There seems to be no immediate prospects of the termination of this unfortunate condition, and there is grave danger that these young people will develop unwholesome and unsocial habits unless they are supervised in some way or other.

If all vocational schools were organized to permit these young people to take up training during a part of each day, much of the danger could be avoided. At the same time, many of these young people would be given an opportunity to take up short-unit courses that would stand them in good stead when they do return to steady employment.

Of course, in some cities it is entirely out of question to try and make the meager school-shop facilities cope with the formidable task that is being suggested. But even with limited facilities at hand, these shops could offer inducements to the unemployed to attend after-school hours and evenings in order to counteract the demoralizing influence of months of idleness. The influence of the pool hall and of the purposeless floating about with members of a gang, would be counteracted at least to some extent by the taking up of a course planned to give insight and skill in some phase of industry which would be of assistance in later life.

In the same way, with probably some additions to the teaching staff, clubwork could be organized which would be helpful during the daytime, to keep some form of supervision over these young people who are forced by adverse circumstances, to be idle. The problem is a large one, but the schools of the country are accustomed to handle large problems, and it is not unlikely that they can cope with this one, gigantic as it seems.

THE FACTOR OF JUDGMENT IN VOCATIONAL TRAINING

The president of a large manufacturing corporation one evening shed his dinner coat, donned a pair of overalls, and spent the entire night at the plant. A monster casting was to be made. He wanted to be on hand to direct the job. When asked why he had not delegated the task to his assistants, he replied:

"Judgment, call it common sense if you will, is a rare ingredient. Things go all right until something of real importance comes along. Then men lose their heads. I prefer to be on hand to keep my men from getting excited, and to see that the big casting is made without accident or interruption."

But to be in possession of judgment is one thing, while it is quite another thing to possess the courage and manhood to give voice to that judgment at the right time and place. And here is what we have in mind: A manufacturer recently said that one of the difficulties he had was to get an honest opinion from his men on matters in which their judgment ought to be better than his own.

"The average man who is asked by his employer for an opinion, immediately becomes a yes-yes man," said the manufacturer. "I invite an opinion because I want to get the other side of a problem. That does not mean that I am ready to follow the advice that is given to me, but it does mean that I want to compare notes between my notion and the other man's notion. Sometimes I am on the right track and some-

times I am wrong. My judgment must finally decide between my own conception of things and the other man's opinion. I am not inclined to decide in my own favor simply because that is a natural thing to do. The other man may be right oftener than I am."

These expressions are subject to some qualifying observations. The real executive manages somehow to secure the exercise of judgment if he cultivates it, and he also enlists honest opinions if he proceeds properly. The average employee, however, is cautious. He knows that some executives are conceited and arbitrary and will resent any opinions which do not coincide with their own.

Nevertheless, the employee, be he journeyman or apprentice, who is asked for an opinion relating to any article of manufacture with which he is familiar, should express himself in accordance with his own judgment. Any weakness, or yes-yes attitude is quickly discovered. An opinion which has merit, and is honestly and fearlessly expressed, will go further than an evasive or subservient answer.

Apprentices who are learning their trade, need to have this called to their attention. It is as necessary for them to acquire the proper attitude on this important question as it is to become well grounded in the technical and manual requirements of their trade.

A METHOD OF DESIGN

The remark that industrial-arts teachers are not well versed in the subject of design, is frequently heard and many of our readers will readily admit that they have seen a great amount of furniture and other projects in school exhibits at state and county fairs which amply bears out this assertion.

For that reason the article on "Dynamic Symmetry," which appears elsewhere in this issue, is well worth the attention of every one of our readers.

Dynamic symmetry is frequently treated from the mathematical standpoint, which at once scares away many who would otherwise profit by it. The treatment in the article referred to, however, is entirely graphical, and careful perusal will show how easily the method can be applied and how flexible it really is.

In this day where every industry is carefully scrutinizing its product to determine where better design will enhance sales values, it is incumbent upon the teacher of industrial arts and vocational education to be equally on the alert for improvements in design in the product which is being turned out in his classroom.

The aid which a knowledge of the method of dynamic symmetry can give in the design work of the classroom, will make the reading of Mr. Cote's article exceedingly worth while.

WHY THE BLACK FOREST CLOCKS WIN

It was in the town of Pontypool, Wales. The writer, an American tourist, entered the leading jewelry shop on the main street, to make a purchase. To his surprise the jeweler bore a German name and spoke with a German accent.

"Why is it that a German should have the leading jewelry shop in a Welsh town?" was the question asked.

"Because we not only possess mechanical skill, but also a sense of art," was the reply. "You will find German jewelers all along from here to Liverpool.

"But just what do you mean by mechanical skill and the sense of art?"

"Do you see that?" said the jeweler, pointing to a clock on the wall incased in a heavy wooden housing. It was large, clumsy, and ungraceful in design.

"Now look at these clocks over here!" he said as he pointed to a group of clocks which were lighter in weight and quite graceful in design. "These well-designed clocks are made by the Black Forest clock makers of Germany. They are beautiful, while that other clock is not. Besides these German clocks cost only one half as much as one of those heavy, ungraceful ones. That tells the whole story. The Germans who are engaged in the clock business in Wales and England all hail from the Black Forest region. It is a matter of price and the touch of art that sells our clocks!"

TEMPER

Recently, while visiting a school shop, the writer witnessed an exhibition which, human as it was, should not have taken place. One of the boys, either out of ignorance, stupidity, or malice, performed a shop operation not only clumsily, but in opposition to all the accepted ways of accomplishing it. The teacher, embarrassed no doubt by the fact that this happened in his class while a visitor was present, flew into a veritable rage.

His actions reminded the visitor of a story which is told about an old Roman, Caius Gracchus by name, who was afflicted by a violent passion and who, when angry, would shout so loudly that his strained voice would not permit him to continue. To overcome this, he appointed one of his servants, Liccinius by name, to be about him continually, ready at such times when the master would feel the surge of anger to sound a pitch pipe that had a soft note, so that Caius would be reminded of not permitting his temper to wreck his voice.

Temper and temperament are equally out of place in the classroom. "He who cannot master himself, cannot master others," is a well-known saying. Probably teachers who are afflicted with a temper might copy Gracchus and carry a pitch pipe. A maxim silencer might also do, but unfortunately these have not yet been invented for the human guns.

The age-old admonition to count 10 when angry before essaying speech, might also be tried by such teachers. At any rate, no matter how, a teacher should control his temper, first of all for his own well-being, and secondly, because by giving way to it, he will only earn the contempt of his students.

AN EARLY CHOICE

We should encourage the choice of a vocation at the earliest possible opportunity; any other course will only widen the gap between school and life.—*L. S. Harding.*

Electrical Shop Test for Grades Seven, Eight, and Nine

*Edward B. Flaherty**

SEVENTH- and eighth-grade classes may answer Questions 1 to 50; they come to shop for two periods a week, for six months.

Ninth-grade classes may answer Questions 1 to 100; they come to shop for eight periods a week for six months.

Directions: The statements which follow are either true or false. Insert the word true or false in the parentheses to show what you think about each statement.

1. A dry cell is a secondary cell. ( )
2. A wet cell has more power than a dry cell. ( )
3. The voltage of a dry cell is 1½ volts. ( )
4. A bell is the source of electricity in a circuit. ( )
5. Copper is a good conductor of electricity. ( )
6. The size of bell wire is No. 10. ( )
7. A three-wire recall system is economical to use. ( )
8. A "T" tap is used to connect two straight wires together at their ends. ( )
9. Accuracy should be observed in laying down work. ( )
10. Pigtail turns in wires retard the current. ( )
11. Loops for connecting wires should be wound to the left. ( )
12. In a two-bell series system there are two circuits. ( )
13. In a three-bell parallel system there is one circuit. ( )
14. The south poles of two magnets repel each other. ( )
15. Bar magnets are made of iron. ( )
16. Neatness requires straight wires and square corners. ( )
17. An annunciator is a signaling device. ( )
18. In a 4-pt. annunciator, there are 4 return wires. ( )
19. A bell transformer is used to give more power. ( )
20. Wire used for transformer installations must be No. 18, rubber covered. ( )
21. Different-colored wires make installation jobs easier. ( )
22. It is sufficient to skin the ends of each of the two wires ½ in. to make a Western Union joint. ( )
23. A Western Union joint must be mechanically and electrically strong. ( )
24. A joint is soldered without using flux. ( )
25. As much rubber must be put on a joint as was taken off. ( )
26. Friction tape is used to hold the rubber in place. ( )
27. When two wires cross each other, a porcelain tube is used. ( )
28. There is no need to hold a porcelain tube in place. ( )
29. A single-pole switch is broken through two wires. ( )
30. A double-pole switch is connected across the line. ( )
31. Two 3-way switches are needed to operate one light from two places. ( )
32. One light controlled from three places needs two 4-way switches. ( )
33. A switch base is needed to raise the wires ½ in. from the surface over which the wire passes. ( )
34. A cut-out is used so that a branch circuit, protected by fuses, may be connected to the main wires. ( )
35. The largest plug-type fuse is 60 amperes. ( )
36. Fifteen-ampere fuses are used for branch circuits. ( )
37. No. 14 R.C. wire is used for branch circuits. ( )
38. A double-pole knife switch is installed, so that gravity closes the switch. ( )
39. A switch should be fastened to a spider cover when used on an outlet box. ( )
40. BX cable should be clipped. ( )
41. It is immaterial what wires are connected when using a pigtail receptacle. ( )
42. Ends of BX should be examined for sharp ends. ( )
43. The volt and the ampere are two electrical units. ( )
44. To find the electrical power in watts, divide the amperes by the volts. ( )
45. Conduit is cut with a rough pipe cutter. ( )
46. To thread conduit put the tapered end of the stock and die on the pipe, turn the guide around to fit snugly; observe that size is on properly, lubricate and start. ( )
47. Ends of pipe must be reamed. ( )
48. Six No. 14 R.C. wires can be put in a ½-in. conduit. ( )
49. A ground clamp is generally soldered to a ground wire. ( )
50. A watt meter is read by taking the higher numbers of each dial. ( )

Select the proper word or words to make the sentence complete and correct, and write it in the space left for it.

51. Electrical staples are made of ( ). [carbon, steel]
52. When current is flowing in a wet cell, the ( ) is eaten away. [carbon, zinc]
53. When current is flowing in a circuit, it is called ( ) circuit. [an open, a closed]
54. A primary cell can be ( ). [charged, cannot be charged]
55. Sulphuric acid and ( ) make the electrolyte of a lead-type storage battery. [water, sal ammoniac]
56. The acid must be poured in ( ). [last, first]
57. The current used for electroplating is ( ). [alternating, direct]
58. The polarity of a circuit can be found by inserting the ends of the wires into a tumbler having ( ). [pure water, acid water]
59. The live wire of an electric street car is the ( ). [trolley, street-car tracks]
60. The size of electrical wires is measured by means of a ( ). [pair of calipers, B & S wire gauge]
61. Heavy wires must have ( ) for connecting the ends. [lugs, loops]
62. The insulation of the cord of a soldering iron is made of ( ). [asbestos, rubber]
63. The best commercial conductor is ( ). [copper, glass]
64. In a series system the intention is to increase the ( ). [voltage, amperage]
65. A bell that rings continuously, as long as you press the push button is a ( ) bell. [vibrating, single stroke]
66. A bell transformer is a ( ) transformer. [step-up, step-down]
67. The secondary leads of a transformer is the ( ) end. [input, output]

*Warren-Bunker Hill School, Boston, Massachusetts.

68. ( ) amperes fuses protect the wires of a bell transformer. [3, 15]
69. An electromagnet is ( ) magnet. [an artificial, a permanent]
70. By ( ) the number of turns of wire in an electromagnet, it increases its strength. [increasing, decreasing]
71. The core of an electromagnet is made of ( ). [iron, steel]
72. Great caution ( ) used where live wires exist. [must be, need not be]
73. An underwriters knot is used to take the strain from the ( ) of an attachment plug. [binding terminals, cap]
74. When a switch is used, a ( ) socket it used in the fixture. [keyless, key, pull-chain]
75. In soldering joints, ( ) flux is preferably used. [muriatic, "Nokorode" paste]
76. A tungsten gas-filled lamp is ( ) efficient than a carbon incandescent lamp. [more, less]
77. An incandescent lamp is colored by using a ( ). [brush, lamp dye]
78. The unit of power is the ( ). [volt, watt, ampere]
79. A kilowatt is equal to ( ) watts. [.0001 watt, 1000 watts]
80. In Ohm's Law, volts = amperes ( ). [watts, Ohms]
81. One electrical horse power is equal to ( ) watts. [746, 476]
82. A fuse is used to ( ) a circuit. [protect, increase the current of]
83. Blown fuses are tested in place when the current is flowing by a ( ). [bell and cell test set, two lamps wired in series]
84. An ammeter is connected ( ) the line. [in series with, across]
85. A voltmeter is connected ( ) the line. [in series with, across]
86. Cleats should be nailed or screwed down ( ). [half their height, their full height]
87. Surface knob and tube work, the wires are ( ) apart. [2½ in, 4 in.]
88. Flexible loom is used in ( ) places. [dry, wet]
89. BX Cable should be ( ) bonded. [not, well]
90. BX is cut by a hack saw in the ( ) of the armor tape. [direction, across]
91. Conduit is bent by means of a ( ). [pipe hickey, machinist's vise]
92. A ( ) makes the best pipe ground. [gas pipe, cold water pipe]
93. Federal bushings are used to prevent wires from ( ). [abrasion, to make them steadier]
94. In an emergency a ( ) switch can be used as a single-pole switch. [3-way switch, a 3-pt. electrolier]
95. A short circuit is caused by ( ). [a break in the wire, crossed wires]
96. Electrical-machine oil holes should ( ). [not be lubricated, be lubricated]
97. A motor gives ( ) power. [mechanical, electrical]
98. A generator gives ( ) power. [mechanical, electrical]
99. A motor-generator set delivers ( ) current. [alternating, direct]
100. A boy is taught to read blue prints so that he can ( ) the work laid out. [understand, make a picture of]

Drawing Tests

*Harry W. Kroll**

THE mechanical-drawing tests submitted herewith have been found very helpful in the author's classes.

The purpose of Scales A, B, and D, is to measure the pupil's acquisition of technical and related information. Scale C measures the skill and accuracy which the student has developed in the use of his drawing tools.

Instructions in Giving Tests

It is not necessary to give more than one test a day. To secure the best results, seat the pupils in alternate seats. Have extra pencils on hand in case a student should break a point during the test period. Do not hold up a class because of one student who may not get the instructions clear, as this may draw the attention of the other students from the test. Give the preliminary instructions as clearly as possible and proceed with the test. Do not lose the test atmosphere before beginning, as this may hamper some of the students from doing their best work. When the students are ready, take the time, and hold strictly to the time period in each test.

Scale A. Hand each student a mimeographed copy of the true-false test shown herein. Give him time to read the directions and then give the signal for beginning the test.

In scoring this test, use the key for checking, and mark those statements which have not been attempted by a dash (—) and those incorrect with a check (√). Do not mark the correct statements. To compute the score in this test, record the total number "not attempted" statements in the space provided. Deduct this number from 40. Multiply the number of "incorrect" statements by two, and subtract the result from the last total. The balance resulting is then taken as the final score which is not given in terms of percentage.

Example of Scoring:

Right	29	Possible Score	40
Wrong	8	Not Attempted	3
Omitted	3		—
	—		37
Total	40	2 × wrong	16
			—
		Score	21

Scale B. This is a reading test in dimensioning. Give the necessary instructions. Parts 1 and 2 are better given at one time, as both do not consume more than a fraction of a class period. Parts 3 and 4 are given together for the same reason.

The score in this test is the number of correct dimensions solved.

Scale C. This test measures the pupil's ability in handling his tools to secure accuracy and correct dimensioning. This test will consume the best part of one period. Advise the student not to spend too much time on one problem, but to work quickly and accurately to secure good results. The score is the total number of correct dimensions.

Scale D. This is a test to determine how well the student can interpret the completed working drawing.

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His ability to read a working drawing is determined by the number of correct lines in the perspective block showing all visible corners of the problem.

The score is the total number of correct lines placed in the perspective block in all four problems.

Median Score

The median score is found by arranging the papers in an ascending or descending order, counting to the middle paper which score represents the median of the class. If there are 50 students the median score falls between the 25th and 26th paper. If there are 21 students the median would fall on the 11th paper.

Scale A–1. Technical and Related Information Test

General Directions: This test is given to find out how much you have acquired regarding technical and related information in drawing.

Read your question carefully and if you do not understand it read it again, but do not guess as there is a penalty for guessing which lowers your score. Do not waste too much time on one statement; come back to it if necessary. This is not a test to see how fast you can go, but how well you can judge each statement.

Directions: The statements below are either true or false. Make a ring around the (T) if you think the statement is correct, but if it is false, mark a ring around the (F).

Sample: A T square is not used in drawing T (F)

True and False Statements

1. Mechanical drawing has no direct vocational value. ..... T F
2. Good lettering is not essential in drawing..... T F
3. Light guide lines should be drawn for good lettering. ..... T F
4. A hard pencil is preferred for lettering..... T F
5. A 5H pencil is softer than a 2H pencil..... T F
6. All Gothic letters have the same width..... T F
7. To have a definite order of strokes in forming each letter is unnecessary..... T F
8. In a working drawing, the object is viewed from as many positions as there are views in the drawing ..... T F
9. Since all objects have more than one surface, all surfaces must be represented whether they can or cannot be seen..... T F
10. The height of an object may be found on the top view ..... T F
11. It is necessary to plan the spacing of the views before beginning the drawing..... T F
12. Blocking out the views of any drawing in skeleton lines improves the speed and accuracy..... T F
13. The left-side view is never placed in line with the front view..... T F
14. The same dimension is never placed on more than one view unless for some obvious reason..... T F
15. The face of the object giving the most information and representing the longest dimension is never selected as the front view..... T F
16. Horizontal lines may be drawn with either the top or the bottom edge of the T square..... T F
17. Hidden edges of an object are shown by long and short dashes alternating..... T F
18. Dimensions must always be read from the right-hand edge of the sheet..... T F
19. Dimension lines should be placed as closely as possible to the face or view being dimensioned... T F
20. When the interior construction of an object is simple and a few hidden corners can easily be shown, a full-section view should be drawn..... T F
21. A full section can be obtained when the cutting plane extends clear through the project..... T F
22. Section lines are used only when the right-side view of any object is drawn in full section..... T F
23. A cross-section view shows the interior and exterior construction of the object..... T F
24. The spacing and kind of section lines used determine the kind of material of which the piece is made..... T F
25. When one view consists of many circles, diameter dimensions are not all placed on these circles..... T F
26. An "over-all" dimension gives the size of each separate part or face of an object..... T F
27. The distance between holes is always given from their center lines..... T F
28. A tangent is a circle touched by a line at one or more places ..... T F
29. The drawing of any object will give its true shape and size ..... T F
30. The detail drawing is one which shows the true shape and size of some part of an object..... T F
31. In drawing cylindrical or circular objects, center lines are drawn first..... T F
32. Two lines continued indefinitely, equal distances apart are said to be parallel..... T F
33. Machine parts are filleted at the corners to improve their appearance ..... T F
34. The size of an object determines the scale to be used..... T F
35. A horizontal line is always at right angles to a vertical line ..... T F
36. Circles can be inked with more than one stroke... T F
37. A degree is a 360th part of a circle..... T F
38. In inking, it is easier to connect a straight line to a curve than a curve to a straight line..... T F
39. Circles and arcs should always be drawn first..... T F
40. Pencil lines that are inked are all made the same weight or thickness..... T F

Right	Possible Score .....
Wrong	Not Attempted .....
Omitted	2 × Wrong .....
TOTAL	SCORE .....

Key to Scale A–1
Possible Score 40

1. F	11. T	21. T	31. T
2. F	12. T	22. F	32. T
3. T	13. F	23. F	33. F
4. F	14. T	24. T	34. T
5. F	15. F	25. T	35. T
6. F	16. F	26. F	36. F
7. F	17. F	27. T	37. T
8. T	18. T	28. F	38. T
9. T	19. F	29. T	39. T
10. F	20. F	30. T	40. F

Key to Scale B–1 and 2
Possible Score 18

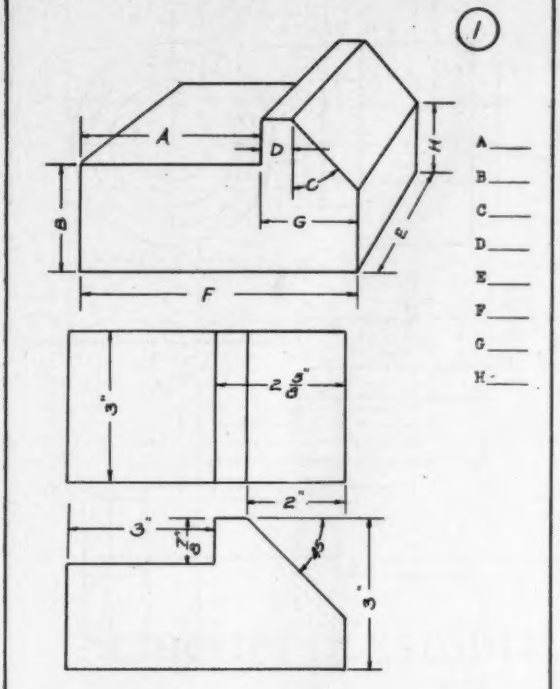
(1)		(2)	
A. 3″	E. 3″	A. 3″	F. 2¼″
B. 2⅛″	F. 5⅝″	B. 2¼″	G. 2″
C. 45°	G. 2⅜″	C. ¾″	H. ⅞″
D. ⅝″	H. 1″	D. 1¼″	J. ½″
		E. 1″	K. 2″

Key to Scale B–3 and 4
Possible Score 30

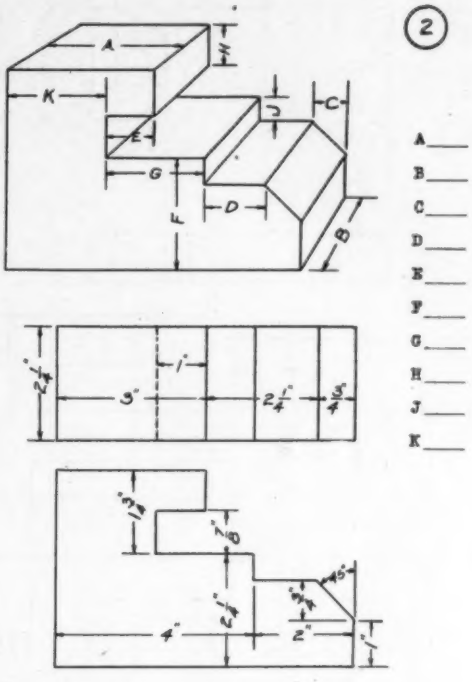
(3)		(4)	
A. 1⅜″	J. 9/16″	A. 1″	J. 1¾″
B. 1¾″	K. 1 5/16″	B. 1¾″	K. ¾″
C. 2¼″	L. ½″	C. 1¾″	L. 5″
D. 3⅛″	M. 6¼″	D. ⅝″	M. ¾″
E. 9/16″	N. ⅞″	E. 3″	N. ¾″
F. 9/16″	O. ⅞″	F. ½″	O. 2½″
G. 1⅛″	P. 2½″	G. ⅝″	P. 1¾″
H. 1¼″		H. ½″	

Scale B--Reading Tests for Mechanical Drawing

B--1 and 2. Directions: From the two lower drawings in part 1 and 2, find out the size of the lettered dimensions in the perspective views and place in the spaces opposite letters as indicated. Time 7 min.



A____
B____
C____
D____
E____
F____
G____
H____



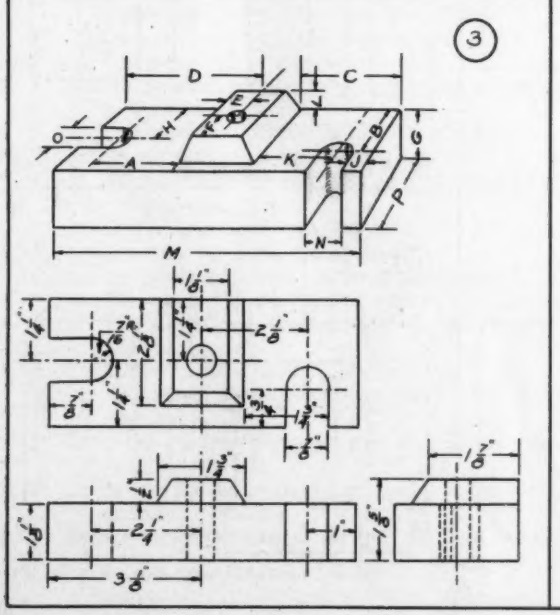
A____
B____
C____
D____
E____
F____
G____
H____
J____
K____

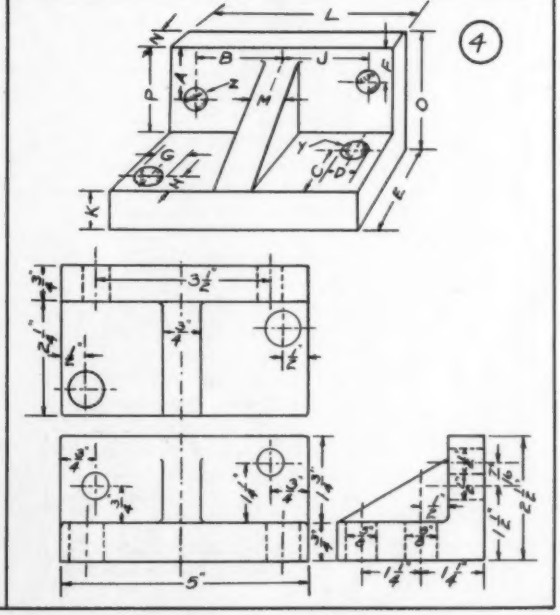
Scale B--Reading Tests for Mechanical Drawing

B--3 and 4. Directions: From the two lower drawings in part 3 and 4, find out the size of the lettered dimensions in the perspective views and place in the spaces opposite letters as indicated. Time 15 min.

A____	D____	G____	K____	N____
B____	E____	H____	L____	O____
C____	F____	J____	M____	P____

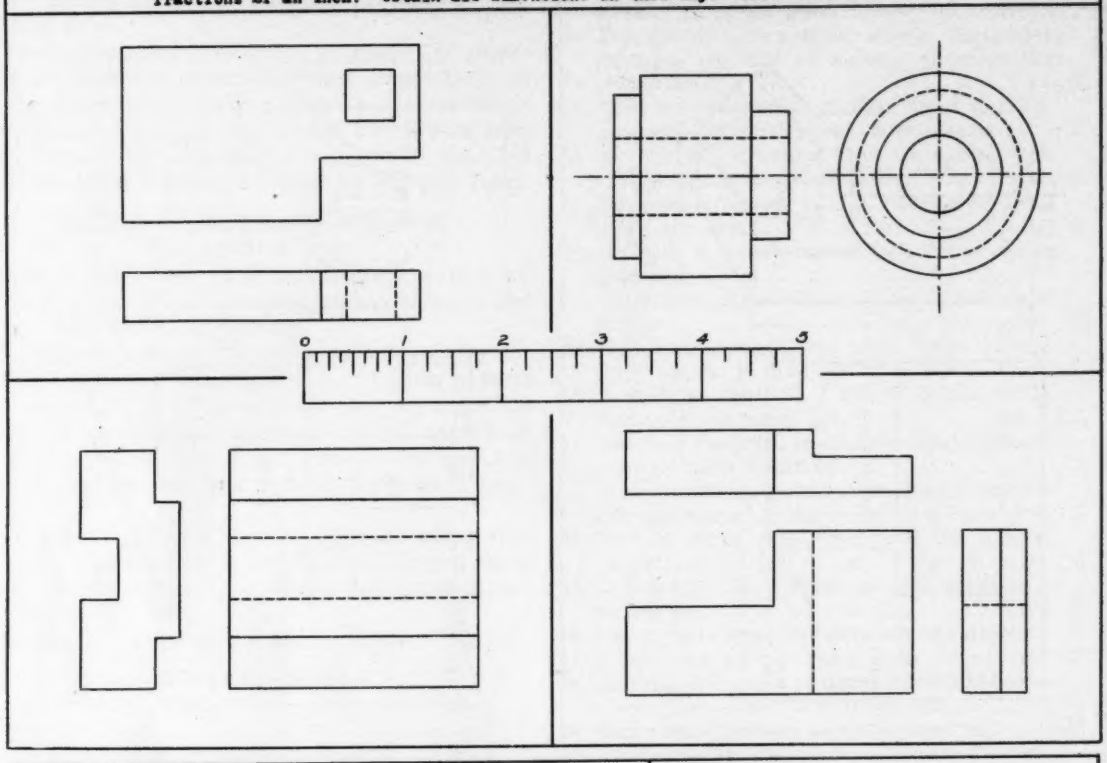
A____	D____	G____	K____	N____
B____	E____	H____	L____	O____
C____	F____	J____	M____	P____





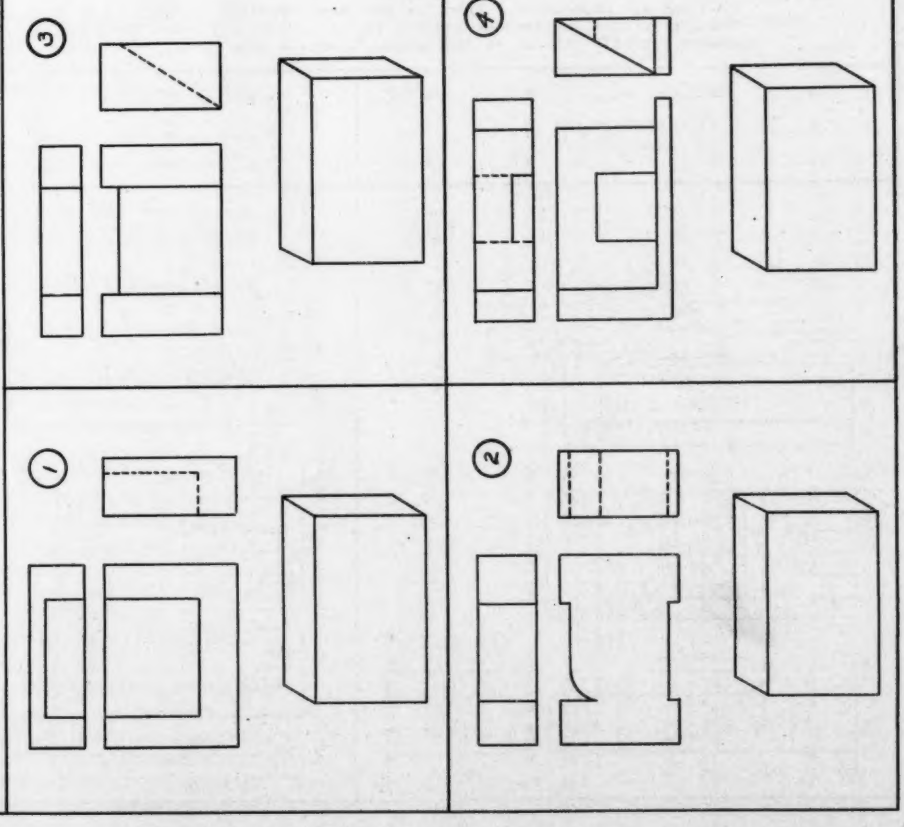
Scale C--Dimensioning Tests for Mechanical Drawing

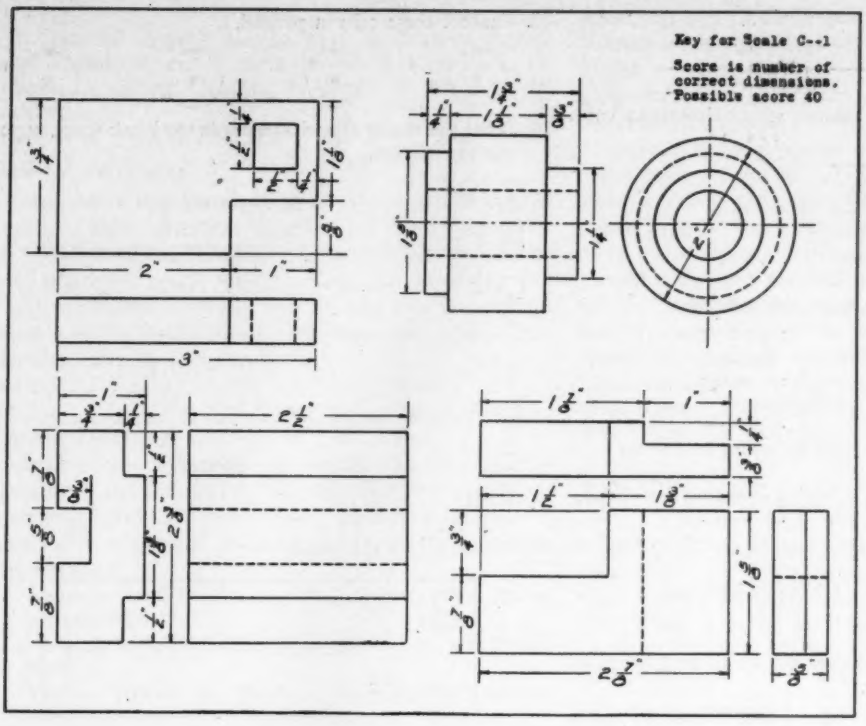
C--1. Directions: Divide the space within your border line into four equal parts and make four working drawings completely dimensioned to the exact size as given. Definite dimensions may be found by placing the dividers on the working drawing, then placing the points on the printed scale to find this distance in inches and fractions of an inch. Obtain all dimensions in this way. Time 35 min.

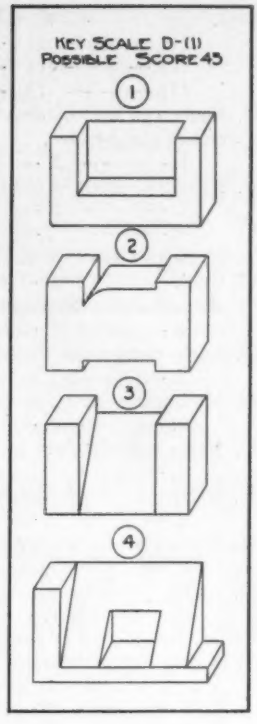


Scale D--Interpretation Tests for Mechanical Drawing

D--1. Directions: In each of the four squares a complete working drawing is made from which you are to complete the perspective drawing. In your perspective block put in only those corners which are visible. Time 20 min.







Semester Examination for Elementary Electricity

*John P. Biddle**

Reference Text: "Essentials of Applied Electricity," by E. W. Jones.

True and False Questions

Directions: Mark a circle around the letter T if the sentence is true, and around F if the sentence is false.

T F 1. Current electricity is the only form useful.
T F 2. Current electricity is electricity in motion.
T F 3. Volt is the unit of electric pressure.
T F 4. One hundred and ten volts of alternating current is found in our homes.
T F 5. Resistance is opposition to the flow of current.
T F 6. Copper wire has high resistance.
T F 7. All high-resistance materials give off much heat when carrying current.
T F 8. Dry cells are used for heavy work.
T F 9. A storage battery stores electricity.
T F 10. Permanent magnets are made of soft steel.
T F 11. The compass is a permanent magnet.
T F 12. The strength of an electromagnet can be controlled.
T F 13. A kilowatt hour is a unit of electric power.
T F 14. The meter mechanically multiplies volts and amperes.
T F 15. To read a kilowatt-hour meter, we read the dials from right to left.
T F 16. All the hands on these dials move in the same direction.
T F 17. We record the number the hand has just passed.
T F 18. We use nichrome wire for heating elements.
T F 19. An electromagnet consists of an iron core and several turns of wire.
T F 20. Magnetism is important in electricity.

Completion Questions

Directions: Fill the blanks with the proper word or words to complete the meaning of the sentence.

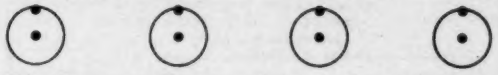
1. Static electricity is produced by ————.
2. Static electricity is in a state of ————.
3. Current is measured with an ————.
4. Voltage is measured with a ————.
5. Ohms are found by ————.
6. The unit of resistance is called an ————.
7. Batteries depend upon ———— action .
8. ———— and ———— adds up in a series circuit.
9. ———— adds up in a parallel circuit.
10. A ———— magnet cannot be used for all purposes.
11. The ———— of a magnet are usually located at the ends.
12. The North pole of the compass points ————.
13. Like poles ————.
14. Unlike poles ————.
15. A line of force is a path of ————.
16. An iron core in an electromagnet adds to its ————.
17. Formula for finding ohms ————.
18. Formula for finding volts ————.
19. Formula for finding amperes ————.
20. Two general kinds of electricity are: 1. ———— 2.————
21. The kinds of current electricity are 1. ———— 2. ————
22. Name three effects of electric current flow and three applications of each effect.

*Liberty Junior High School, Hutchinson, Kansas.

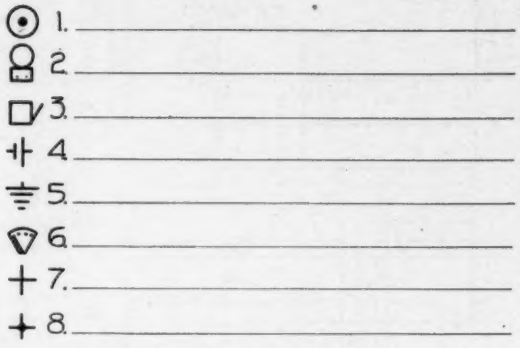
1. 2. 3.
(1) ——— (1) ——— (1) ———
(2) ——— (2) ——— (2) ———
(3) ——— (3) ——— (3) ———

23. Name two uses of direct current where alternating current cannot be used.
1. ——— 2. ———
24. Name five kinds of insulators.
1. ——— 2. ——— 3. ———
4. ——— 5. ———
25. Name two kinds of magnets:
1. ——— 2. ———
26. Name three conductors having a low resistance.
1. ——— 2. ——— 3. ———
27. Name three magnetic substances.
1. ——— 2. ——— 3. ———
28. Name three nonmagnetic substances.
1. ——— 2. ——— 3. ———
29. Name one advantage of having resistance in a circuit.
1. ———
30. Name three disadvantages of having resistance in a circuit.
1. ——— 2. ——— 3. ———
31. Write the formula for finding cost of electric power for 10 kilowatt hours at 5 cents.
32. Name four steps in reading a kilowatt-hour meter.
1. ——— 2. ———
3. ——— 4. ———
33. Figure cost of following devises for 10 kilowatt hours at 5 cents per kilowatt hour.
1. Toaster using 110 volts and 5.5 amperes.
2. Toaster using 110 volts and 6 amperes.
3. One hundred and fifty-watt lamp using 110 volts and 1.2 amperes.
4. Electric iron using 110 volts and 5 amperes.
34. Connect these cells in series.

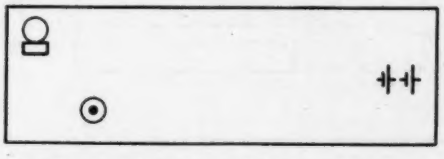
35. Connect these cells in parallel.



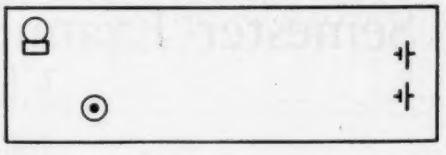
36. Write the names of each symbol in the blank space, opposite the number.



37. Connect these symbols in series.



38. Connect these symbols in parallel.



Woodworking Tests

W. G. *Hjertstedt**

PATTERN-SHOP TEST

General Directions

The aim of this examination is to give you an opportunity to show what you have learned from your study of patternmaking. It is not expected that you will be able to answer every question. Read the directions carefully and be sure you understand what you are to do before you begin. Use upper-case Roman lettering exclusively:

Name .....Room .....School .....
Course .....Age .....Date .....

Specifications

Each of the following statements can be correctly completed by the use of one, and only one, of the expressions. Underline the correct expression contained in the parentheses in each sentence.

1. The color of lac in its original form is (white, orange, blood red, yellow, black).
2. Cores are made of (wood, sand, metal, brass, iron).
3. The upper part of a molding frame is called (cope, drag, flask, upper part).
4. Whenever a machine drawing of a small pattern calls for finish, add another line (3/16 in., ⅛ in., ¼ in., ⅝ in.) from the surface to be finished.
5. When a great many castings are to be made, a pattern made of (yellow pine, poplar, metal, white pine) is used.
6. To allow for a depression in the molding sand to hold the core a (core print, projection, extension, hole) is used or allowed on the pattern.
7. If the pattern is intended for molding cast iron, the body of the pattern is made (natural color, black, orange, red).
8. The core prints of a pattern are painted (natural, black, orange, red).
9. The red color used for patterns is made by mixing (chrome, vermillion, burnt umber, ultramarine).
10. The black color used for patterns is made by mixing shellac with (lamp black, burnt umber, ultramarine).
11. Edges to be glued should be (concave, convex, rough, shellacked, straight).
12. Garnet paper is used for (dusting, polishing, sanding, scraping, sizing).
13. A curved chisel is called a (butt chisel, gouge, mortising chisel, skew chisel).
14. Slip stones are used to sharpen (bits, chisels, gouges, knives, saws).
15. In sharpening a plane blade the cutter should have (one bevel, two bevels, three bevels, four bevels.)
16. White pine is best for (furniture, inside finishing, posts, siding, stairs, patterns).

*Roosevelt Senior High School, Chicago, Illinois.

Key

1. blood red, 2. sand, 3. drag, 4. ⅛ in., 5. metal, 6. core print, 7. black, 8. red, 9. burnt umber, 10. lamp black, 11. straight, 12. sanding, 13. gouge, 14. gouges, 15. one bevel, 16. patterns.

WOODSHOP TEST

General Directions

The aim of this examination is to give you an opportunity to show what you have learned from your study of cabinetmaking. It is not expected that you will be able to answer every question. Read the directions and every statement carefully and be sure you understand what you are to do before you begin. Use upper-case Roman lettering exclusively:

Name ..... Room .....
Course ..... Age ..... Date .....

Specific Directions

Each of the following statements can be correctly completed by the use of one and only one of the expressions within the parentheses. Underline the correct expression contained in the parentheses to complete the sentence.

1. Shellac is thinned with (turpentine, alcohol, boiled linseed oil, gasoline).
2. Cedar is best for (dressers, lamps, chests, book racks, tables).
3. Varnish brushes are made of (wire, string, feathers, bristle).
4. A rule is divided into (sixteenths, fifths, thirteenths, seventeenths).
5. A mortise and tenon is used in (drawing, furniture making, house building, painting, roofing).
6. The manufacture of furniture is called (cabinetmaking, joinery, patternmaking).
7. Brushes that have been used in shellac should be cleaned with (oil, turpentine, alcohol, gasoline).
8. Three-ply is the name of (finish, paneling, varnish, veneer).
9. Walnut is (dark, light, red, white, yellow).
10. Dividers are used for making (squares, oblongs, circles, triangles).
11. Joinery is used in the construction of (plastering, bricklaying, furniture, plumbing).
12. For gauging the thickness of the shaving of a plane, regulate the (cap screw, handle bolt, knob bolt, adjusting nut).
13. Varnish brushes should be cleaned with (oil, water, turpentine, alcohol).
14. Screws are used for (drawing, fastening, finishing, lighting, planing).
15. Henry Disston and Sons manufacture (planes, screws, bits, saws).
16. The best joint for a picture frame is (dovetail, miter, half-lap, butt).
17. Coping saws are used to cut (bevels, squares, miters, irregular shapes).

Key

1. alcohol, 2. chests, 3. bristle, 4. sixteenths, 5. furniture making, 6. cabinetmaking, 7. alcohol, 8. veneer, 9. dark, 10. circles, 11. furniture, 12. adjusting nut, 13. turpentine, 14. fastening, 15. saws, 16. miter, 17. irregular shapes.

WOODSHOP TEST

General Directions

The aim of this examination is to give you an opportunity to show what you have learned from your study of cabinetmaking. It is not expected that you will be able to answer every question. Read the directions and every statement carefully and be sure you understand what you are to do before you begin. Use upper-case Roman lettering exclusively:

Name ..... Room .....
Course ..... Age ..... Date .....

Specific Directions

Some of the statements are true and some are false. Read each statement carefully. The words True and False precede each statement below. Underscore the word True if the statement is true. Underscore the word False if the statement is false. Do not guess at a question that you are sure you do not know. If you are unable to decide whether a statement is true or false, leave it alone. You will be penalized for each statement incorrectly marked by deducting one point of credit from the number of correctly marked statements.

True False 1. Surplus stain is wiped off.
True False 2. After paste filler has been applied, the surface must be rubbed across the grain.
True False 3. After the first coat of shellac is applied with fine sandpaper, the surface should be rubbed.
True False 4. Paste filler is thinned with turpentine.
True False 5. Wet lumber shrinks.
True False 6. An expansion bit has no adjustment cutter.
True False 7. The serrations of a file extend obliquely across the tool.
True False 8. The length of a board is measured across the grain.
True False 9. When using a backsaw the blade should be in a horizontal position.
True False 10. When using a saw too rapidly, the blade becomes hot.
True False 11. The most accurate way of using a folding rule is to turn it on edge.
True False 12. The brace and bit is used to drill holes.
True False 13. A countersink is used to ream out a conical-shaped hole.
True False 14. A crosscut saw is used to cut with the grain.
True False 15. In sawing a board, the cut is made on the backward stroke.
True False 16. The beam of a try-square must be held firmly against the straight edge of the piece of wood.
True False 17. A vise should be tightened by the weight of the body.
True False 18. To prevent the corners digging into the surface, the cutter blade should be slightly crowned.
True False 19. A vise is tightened by turning the handle to the left.
True False 20. A hammer should be held near the head.

Key

1. T, 2. T, 3. F, 4. T, 5. F, 6. F, 7. T, 8. F, 9. T, 10. T, 11. T, 12. F, 13. T, 14. F, 15. F, 16. T, 17. F, 18. T, 19. F, 20. F.

SHEET-METAL SHOP, FINDLAY VOCATIONAL SCHOOL, FINDLAY, OHIO

Machine-Shop Test

*George C. Donson**

Some of the following statements are true and some are false. Mark an F before each false statement and the letter T before each true statement.

1. ..... A fine file is used for polishing turned work in the lathe.
2. ..... An independent chuck is used for holding an irregular-shaped piece of work.
3. ..... A taper may be turned by changing the angle of the cutting tool.
4. ..... The lead screw and the feed rod are one and the same on some makes of lathes.
5. ..... The universal chuck has independent acting jaws.
6. ..... A dog is used for holding the work between the lathe centers.
7. ..... The live center is a part of the headstock spindle.
8. ..... The follower rest is a part of the carriage.
9. ..... The center rest is attached to the bed.
10. ..... The cutting angle on a tool is called "rake" or "clearance."
11. ..... When filing cast iron in a lathe the r.p.m. should be 100 or less.
12. ..... To prevent vibration in turning irregular work, a counter balance may be bolted to the chuck or faceplate.
13. ..... A drill is properly ground when it has an angle clearance of 39 degrees and a lip clearance of 10 degrees.
14. ..... A drill should have no clearance in drilling brass.
15. ..... If a drill runs out of center, it is improperly ground or bent.
16. ..... High-speed drills are less expensive than carbon-steel drills.
17. ..... The smaller the drill the higher the speed.
18. ..... The usual graduations on a machinist scale are ⅛ in. and 1/16 in.
19. ..... The dividers should be placed in the middle of the scale when taking measurements.
20. ..... A lead pencil is used to mark lines on metal.
21. ..... A center gauge is used to test the grinding of a thread cutting tool.
22. ..... A safe edge file has one smooth edge.
23. ..... A half-inch hole should be drilled for a half-inch bolt tap.
24. ..... The lead screw usually has a square thread.
25. ..... The standard pipe thread in the United States is the Whitworth.
26. ..... The S.A.E. thread is finer than the U.S.S. thread.
27. ..... A fast speed and a fine feed should be used in machining C.I.
28. ..... The hand hack saw should be operated like a wood crosscut saw.
29. ..... It is dangerous to use unhandled files when filing work in the lathe.
30. ..... When machining steel, the point of the cutting tool should be set 1/64 in. above center.

*Washington High School, Washington, Pennsylvania.

Some Mechanical-Drawing Tests

*August Flam**

Test No. 1, (Best-Answer Type)

Directions: Underscore the word or words in each statement which makes the best sense in the following statements:

1. In orthographic projection objects are represented by (1) a single view, (2) two or more views, (3) any number of views.
2. The top view of an object never gives (1) the height, (2) the length, (3) the width.
3. Slanting surfaces are (1) lengthened, (2) foreshortened, (3) unchanged, in the usual end view.
4. The auxiliary view shows the slanting surface (1) distorted, (2) in its true shape and size, (3) elongated.
5. An angle is the (1) area, (2) opening, (3) distance, formed by the intersection of two lines.
6. A tangent is a line (1) that touches a circle at one point only, (2) that touches a circle at one or more points, (3) that does not touch the circle to which it is tangent.
7. The pitch of a screw is (1) its diameter, (2) the length of its threaded part, (3) the number of threads per inch of length.
8. A small threaded hole is said to be (1) taped, (2) reamed, (3) countersunk.
9. In developing a right circular cylinder there results (1) a square, (2) a rectangle, (3) a parallelogram.
10. In isometric projection, measurements may be taken (1) on any horizontal line, (2) on any vertical line, (3) on isometric lines.
11. In inking a pencil drawing the lines should be (1) heavy, (2) of the same grade of thickness, (3) some light, some heavy.
12. A full section is obtained when the cutting plane is assumed (1) to extend halfway through the object, (2) to extend clear through the object, (3) not to cut through the object at all.
13. Both the exterior and interior of a symmetrical object may be shown on one view by means of a (1) half section, (2) full section, (3) partial section.
14. If a circle is parallel to a plane, its projection on that plane is (1) a straight line, (2) a circle, (3) an ellipse.
15. The form of screw threads generally used in this country is (1) the sharp V thread, (2) the Acme Standard thread, (3) the U. S. Standard thread.

Answers

1. (2)	5. (2)	9. (2)	13. (1)
2. (1)	6. (1)	10. (3)	14. (2)
3. (2)	7. (3)	11. (3)	15. (3)
4. (2)	8. (1)	12. (2)	

Test No. 2, (True-False Type)

Indicate a true statement by a capital T, or a false statement by a lower-case letter f placed in parentheses at the end of each statement.

1. Lettering is of no particular importance in mechanical drawing. ——( )
2. Guide lines should never be drawn for the tops and bottoms of each line of lettering. ——( )

*Manual Arts High School, Los Angeles, California.

3. The shapes of the figures used on drawings are just as different from those used in ordinary figuring as the letters are from ordinary writing. ——( )
4. A 4H pencil is harder than a 2H pencil. ——( )
5. Of the two pencils the 4H is used for lettering and the 2H for drawing lines. ——( )
6. In orthographic projection, objects are represented by a single view. ——( )
7. Since it is necessary to describe every part of an object, all surfaces must be represented whether they can actually be seen or not. ——( )
8. Horizontal lines may be drawn with either the top or bottom edge of the T square.
9. The top view of an object never gives the height. ——( )
10. Surfaces which exist but which are invisible are represented by long and short dashes alternating. ——( )
11. Where the interior of an object is not very complicated, a section should be taken. ——( )
12. When two pieces are shown in section together, they are cross sectioned by lines running in the same direction. ——( )
13. Such parts as bolts, nuts, screws, and shafts, are not usually sectioned. ——( )
14. The two essential things to be told about any object are its shape and size. ——( )
15. If a circle is parallel to a plane, its projection on that plane is a straight line. ——( )
16. The dimension line is made up of long dash lines. ——( )
17. The same dimension is not repeated on different views unless there is a special reason for it. ——( )
18. Dimensions should never be given from center lines. ——( )
19. A line of the drawing should never be used as a dimension line. ——( )
20. The drawing of a separate part is called a "detail drawing." ——( )
21. An angle is the distance inclosed by two non-parallel lines. ——( )
22. A tangent is a line touching a circle or a part of a circle at one or more points. ——( )
23. Two lines are said to be parallel if they do not meet when produced indefinitely.
24. A horizontal and a vertical line intersect at right angles. ——( )
25. A degree is 1/360th part of a minute.
26. A small threaded hole is said to be tapped. ——( )
27. In isometric projection, measurements may be taken on any horizontal or vertical line. ——( )
28. Nonisometric lines are lines not parallel to the isometric axes. ——( )
29. An assembly drawing should carry all the dimensions for making all the parts. ——( )
30. In inking a pencil drawing, all the lines should be of the same thickness. ——( )
31. All straight lines are inked with the ruling pen. ——( )
32. To fill the ruling pen, dip it lightly into the ink bottle. ——( )
33. Circles should always be inked with one stroke, inclining the compass in the direction of the line. ——( )
34. In inking, it is much easier to connect a straight line to a curve than a curve to a straight line. ——( )
35. It is a rule in inking that circles and circular arcs must be drawn first. ——( )

Answers

1. (f)	3. (T)	5. (f)	7. (T)
2. (f)	4. (T)	6. (f)	8. (f)
9. (T)	16. (f)	23. (T)	30. (f)
10. (f)	17. (T)	24. (T)	31. (T)
11. (f)	18. (f)	25. (f)	32. (f)
12. (f)	19. (T)	26. (T)	33. (T)
13. (T)	20. (T)	27. (f)	34. (T)
14. (T)	21. (f)	28. (T)	35. (T)
15. (f)	22. (f)	29. (f)	

Test No. 3, (Completion Type)

Directions: Fill in the correct answers in the spaces left blank in each statement below.

1. The ———, the ———, and the ——— views of a simple solid object are usually required to fully describe it.
2. Surfaces which exist but which are invisible are shown by means of ———.
3. The ——— view of an object never shows the height.
4. A vertical line is one which is at right angles to a ——— line.
5. To draw an object 3 ft. long in a space which is but 14 in. long, a scale of ——— per foot should be used.
6. The usual slant for section lining is ———.
7. Such machine parts as (1) ———, and (2) ———, and (3) ——— are never sectioned on a drawing.
8. The section lining on a small piece would be ——— than the section lining on a large piece.
9. In order to construct an ellipse we must have given the ——— and the ———.
10. The number of threads per inch of threaded length on a bolt is termed its ———.
11. The form of screw threads most commonly used in this country is the ——— thread.
12. A small threaded hole is said to be ———.
13. When a right circular cylinder is developed (stretched out), the figure that results is a ———.
14. A regular hexagon may be constructed when we have given (1) ———, or (2) ———.
15. The two arrowheads at the ends of a pair of dimension lines should always point ———.
16. Orthographic projection represents an object on ———, which are at ——— angles to each other.
17. A center line is made up of ———.
18. A surface slanting in front view is ——— in the end view.
19. In inking a pencil drawing, the ink lines should be of ——— thickness.
20. A half section shows the ——— of half the object, and the ——— of the other half.

Answers

1. Front, Top, End
2. Dotted lines
3. Top
4. Horizontal
5. 3″
6. 45°
7. Bolts, Nuts, Shafts
8. Closer together
9. Major, Minor axes
10. Pitch
11. U. S. Standard
12. Tapped
13. Rectangle
14. (1) The length of a side; (2) The distance across flats
15. In opposite directions
16. Planes, Right
17. Long and short dashes alternating
18. Foreshortened
19. Varying grades of
20. Interior, Exterior

TRADE TRAINING

The great thing for the working man of today is a steady job. The laboring man of today needs to attend evening school in order to hold a steady job. Greater improvement in a trade adds to his self-confidence, and he will be broad-minded, happy, and a more competent worker.—*I. B. Morgan.*

PROBLEMS AND PROJECTS

This department aims to present a wide variety of class and shop projects in the Industrial Arts. Successful problems are invited and will be paid for. A brief description of constructed problems, not exceeding 250 words in length, should be accompanied by a good working drawing. The originals of the problems in drawing and design should be sent.

Problems in woodworking, turning, patternmaking, machine-shop practice, sheet-metal work, forging, foundry work, auto mechanics, auto electricity, electricity, architectural and mechanical drafting, printing, bookbinding, concrete work, farm mechanics, home mechanics, and other lines of industrial-arts work are desired for consideration.

A TORCHERE

J. W. Bollinger, Tulsa, Oklahoma

The torchere shown in Figure 1 is a novel type of floor lamp. An electric-light socket known as a "candle fixture," resembling a candle, and colored, flame-shaped bulbs to resemble a candle flame or torch flame, may be used with it. The "cups" and "shades" which are part of the torchere, emphasize the use of large candles or torches as part of the design.

Cut the two base pieces as specified. To shape the feet, upset the ends of the pieces, then beat them out thinner and wider. Grind and file them to shape as shown. Lines to accent the design may be put in with the help of a special chisel. Curve the ends, making sure that all four are alike. The two pieces are then cut to form a half-lap joint at the center, which may be fastened together by means of four countersunk rivets, or by welding.

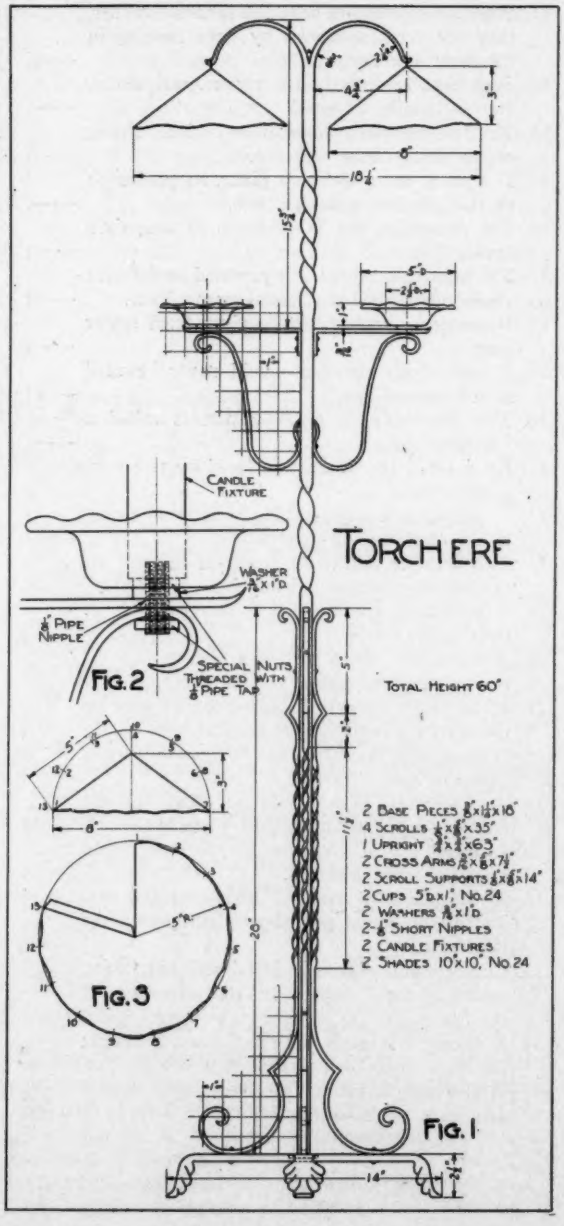
Saw down the center of the upper end of the upright for a distance of 7 in., and curve the pieces outward. If they are hammered out to a long taper, their appearance will be greatly improved. There are two twisted portions in the upright, one 5 in. long beginning 28 in. from the bottom end (and corresponding to the top of the braces), and another 8-in. twist just above where the supports for the candle fixtures are to be placed. To make one of the twists, heat the iron at that place to a uniform temperature, clamp it in the vise at the point where the twist is to begin, grasp it with a large monkey wrench at the place where the twist is to end, and turn the metal through as many revolutions as desired. The upright may be fastened to the base by means of a long ½-in. bolt through the half-lap joint, or by welding. Make sure that the upright stands perfectly straight.

Make a full-size drawing on a piece of squared paper of the curve to which to shape the lower part of the four scrolls or braces. Taper two sides of the ends of the pieces for the scrolls about ½ in.; shape the curve over the anvil, and check with the drawing. The sharp bend can be made by placing the iron in the vise at that point and striking it with a hammer. Shape the upper end of the scrolls in a similar manner. Put in the twists in the same way as described above for the upright, except that the twists can be made while the iron is cold. Sight along the twist to test for straightness; clamp the iron in the vise and pull it straight by hand. Do not use a hammer.

Fasten the braces in place by means of 3/16-in. rivets. One procedure is to rivet all four braces to the base first, then drill each of the holes through two braces and the upright as one operation.

Shape the cross arms. Notice that the outer ends are tapered and curved. Drill a ⅜-in. hole 5 in. out from the upright. Fasten the pieces in place by means of two 3/16-in. rivets.

Make a full-size drawing on squared paper of the curve to which the scroll supports are to be shaped. Taper the ends of the piece of iron; curve them over the anvil, and check with the drawing. Drill a ⅜-in. hole in each of these pieces, to line up with the ⅜-in. holes in the cross arms described above. Fasten the scroll supports to the upright by means of a 3/16-in. rivet.



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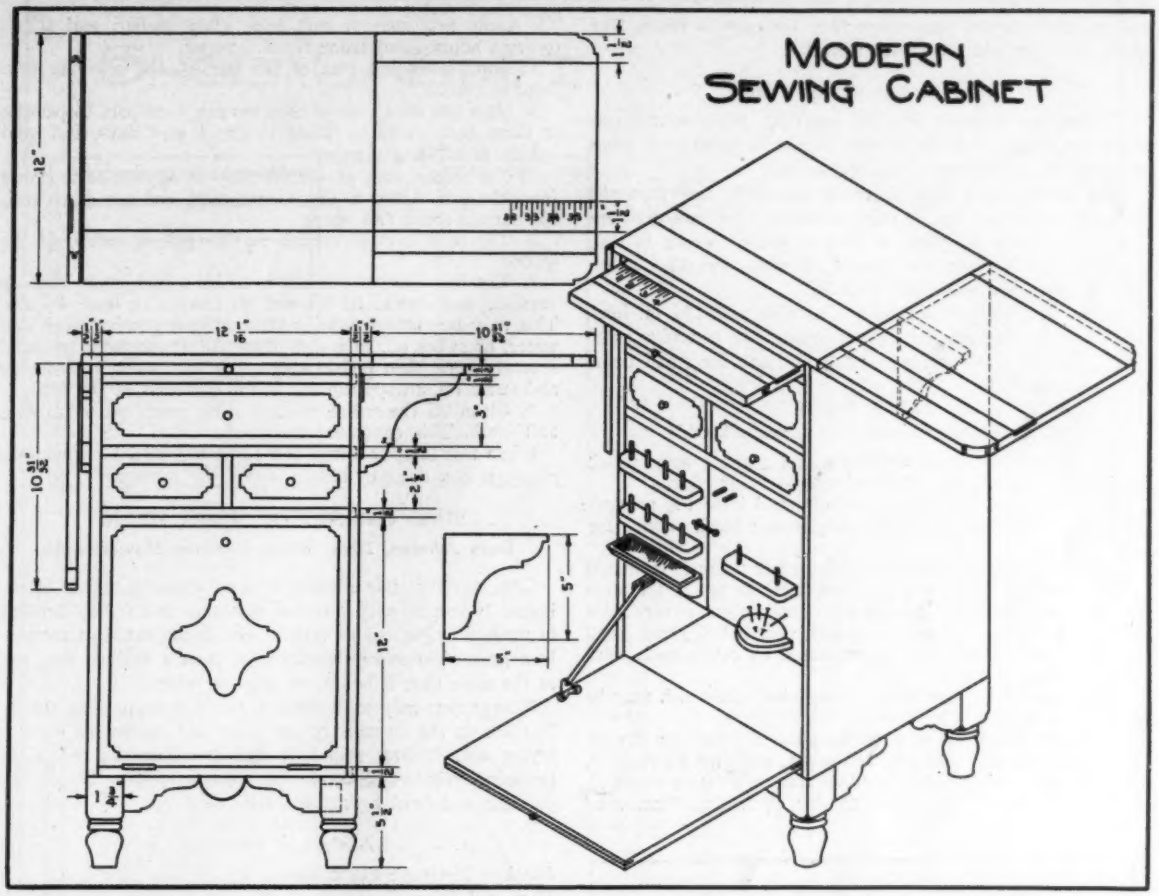


Cut the two special washers on the lathe, 3/16 in. thick and 1 in. outside diameter, drilled ⅜ in.

Make the cups as follows: Cut two pieces of No. 24 sheet iron about 6 in. square. Get a large iron pipe collar, having an inside diameter of 2½ in., place the sheet of iron over this collar and beat it with a ball-peen hammer to the shape shown in the drawing. Begin at the outer edge and work inward, using only light blows. Hammering the iron in this way will cause it to stretch and harden; to soften or anneal it, heat it and allow it to cool slowly. It may be necessary to do this three or four times before the final shaping is completed. Find the center of the "dished" portion, and draw a 5-in. circle on the iron. Cut the iron the size of this circle, and scallop the edge as shown. Drill the center with a ⅜-in. drill.

The method of fastening the cup and the other parts together is illustrated in Figure 2. Secure two ⅛-in. short pipe nipples, 1 in. long, or make them by continuing the threads on a piece of ⅛-in. pipe. Get four ⅛-in. pipe lock washers from a chandelier supply house, or make them by cutting ⅛-in. pipe threads through hexagonal pieces of ⅛ by ⅝-in. iron. The pipe nipples are to extend through the cups, the washers, the cross arms, and the scroll supports, and are to be clamped in place by means of a lock nut on each end. A part of the pipe nipple is to project up above the lock nut inside the cup; the candle fixture will screw on to this part of the pipe nipple.

The development of the cone-shaped shades is shown in Figure 3. The edges are to be scalloped as shown, as were the cups described in the foregoing. The shades are riveted with small tinner's rivets, and are hung from the curved ends of the upright by means of small rings made of stovepipe wire.

Two wires are to run from each candle fixture through the pipe nipples and are to be connected in parallel where they meet at the upright. Drill a 5/16-in. hole through the upright just below where the cross arms are fastened on, and have the joint in the wires concealed in this hole. The wire then runs down the upright and may be carried through a hole in the base to the wall outlet.

Give the finished job two coats of flat black paint, and spot the surface after the second coat has been applied with deep-gold bronzing powder.

MODERN SEWING CABINET

Ken. F. Shepardson, Albion State Normal School, Albion, Idaho

The modern sewing cabinet, herewith described, contains many attractive features not found in other sewing cabinets. It has been tried out and found to be successful.

When the cabinet is closed and the leaves dropped, it takes up but a square foot of floor space. When the leaves are raised, the top surface is 12 by 36 in., which is ample room for an electric sewing machine, or when it is used as a card table, or as a bedside table. The top is inlaid with a 36-in. rule.

Beneath the top is a sliding shelf which is inlaid with a 12-in. rule. Below the sliding shelf are three drawers — one full width, the other two half widths. Beneath the drawers is a 12 by 12-in. door, which, when open, forms a shelf for the sewing basket. The space inside of the door is for the sewing basket and any unfinished sewing.

Hinged to the inside of the cabinet are two doors. When closed and not in use they are parallel with the sides of the cabinet — inside of the cabinet. When open, the doors are flush with the drawers and the front of the cabinet. This places the spool holders, button tray, pincushion, darning

cotton, and scissors pegs where they are easy to reach. The doors may be held open with a hook.

Some Hints as to Construction

The cabinet is made of ½-in. material. Many of the surfaces are wide and liable to warp if not battened or if green stock is used. Mahogany is very suitable.

The inlaid rules can be made of birch and numerals stamped on with a set of steel numbers. The inch divisions are nicked with a chisel. A coat of black lacquer is then applied over the rule and sanded off when dry. This leaves the divisions and numerals in black.

Seven pair of butt hinges, ½ in. wide and 1½ in. long, one chest-lid support, five drawer knobs, one cartridge catch for 12 by 12 door, and one catch or hook for small doors are required.

TABLE LAMP

E. Crawford Houston, East Cleveland, Ohio

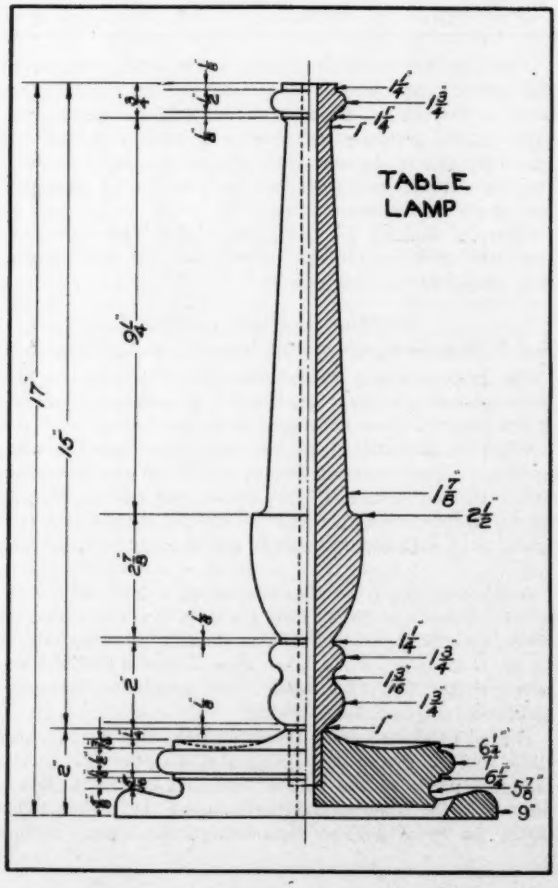
The accompanying illustration shows a table lamp which presents a problem for advanced wood-turning classes.

Care and selection of the kind of wood is of the greatest importance. We unhesitatingly recommend black walnut for this project.

This lamp involves spindle and faceplate turning. It should not be overlooked that a ⅜-in. hole must be put in the stem of the lamp before it is turned up. If solid stock is used, this ⅜-in. hole must be bored from each end, but if glued stock is used, a groove 3/16 by ⅜ in. should be cut in each piece before gluing.

After the turning has been accomplished, the finish may be put on as follows:

1. Sponge the wood with water, allow 8 hours for drying. Then sand smooth with No. 3/0 paper, and dust thoroughly.
2. Stain the wood with a good reliable water stain of standard walnut shade, and allow to dry overnight. Then sand lightly.



3. Apply first coat of thin pure white shellac, and allow to dry 8 hours. Sand, using No. 3/0 paper.
4. Apply a second coat of the shellac, and allow to dry. Sand as before.
5. Next put on a coat of thin varnish (one part turpentine to three parts varnish), allow to dry 3 or 4 days, and sand lightly with No. 3/0 paper.
6. The second coat of varnish may be applied as it comes from the can. Allow to dry 3 or 4 days, and rub down with FF pumice stone and water.
7. The third coat of varnish may be put on exactly as the second.
8. The last coat of varnish is to be a high-grade rubbing varnish, and should be allowed to harden at least 4 days. This may be rubbed down with the finest pumice stone and water, or sweet oil, to a dull gloss. Allow the work to stand several hours, then polish with a felt pad, using rottenstone and sweet oil, always rubbing in the direction of the grain.
9. Clean off the entire surface, using sweet oil on a clean soft cloth. This concludes the finish.

When this lamp is wired and furnished with a harmonious shade, it is a thing of beauty and a joy forever.

SHOE CABINET OF SHEET METAL

Dean Johnson, High School, Gardner, Massachusetts

This novelty shoe cabinet is a very useful article in the home. It is a novelty piece of furniture and is best finished in modern bright colors, stripes, etc. Being made of metal it is a great deal more cheaply built than a wooden one, and at the same time it is just as good or better.

This project may seem difficult, but it is really quite simple. It takes in the elementary processes and operations such as laying out, folding slide-lock seams, reënforcing edges by hemming, reënforcing by wiring, riveting, making hinges, and painting and finishing metal work.

Analysis of Procedure

Stock — 26-Gauge Black Iron

Back and Sides Piece —

1. Study the blue print, then start laying out the piece for the back and sides, using a square and a scratch awl.

it, cut to the lines with a squaring shears or tinners' snips.

3. Fold the hems on the top and bottom edges.
4. Fold in for the slide seam on the front of the side edges, 7/16 in. closed, then ½ in. at right angles.
5. Place the piece in the cornice brake and fold for sides.

Shoe Shelves — Two Required

1. Lay out the shoe shelves according to the blue print.
2. Show the layout to the instructor; if O.K., cut out.
3. Use this as a pattern for the other tray and cut out.
4. Fold all edges so that the folds will be out when the shelf is finished.

a) Fold the front and back edges 7/16 in. then ½ in. closed hem.

b) Fold the end edges 7/16 in. then 7/16 in. but not too close or tight.

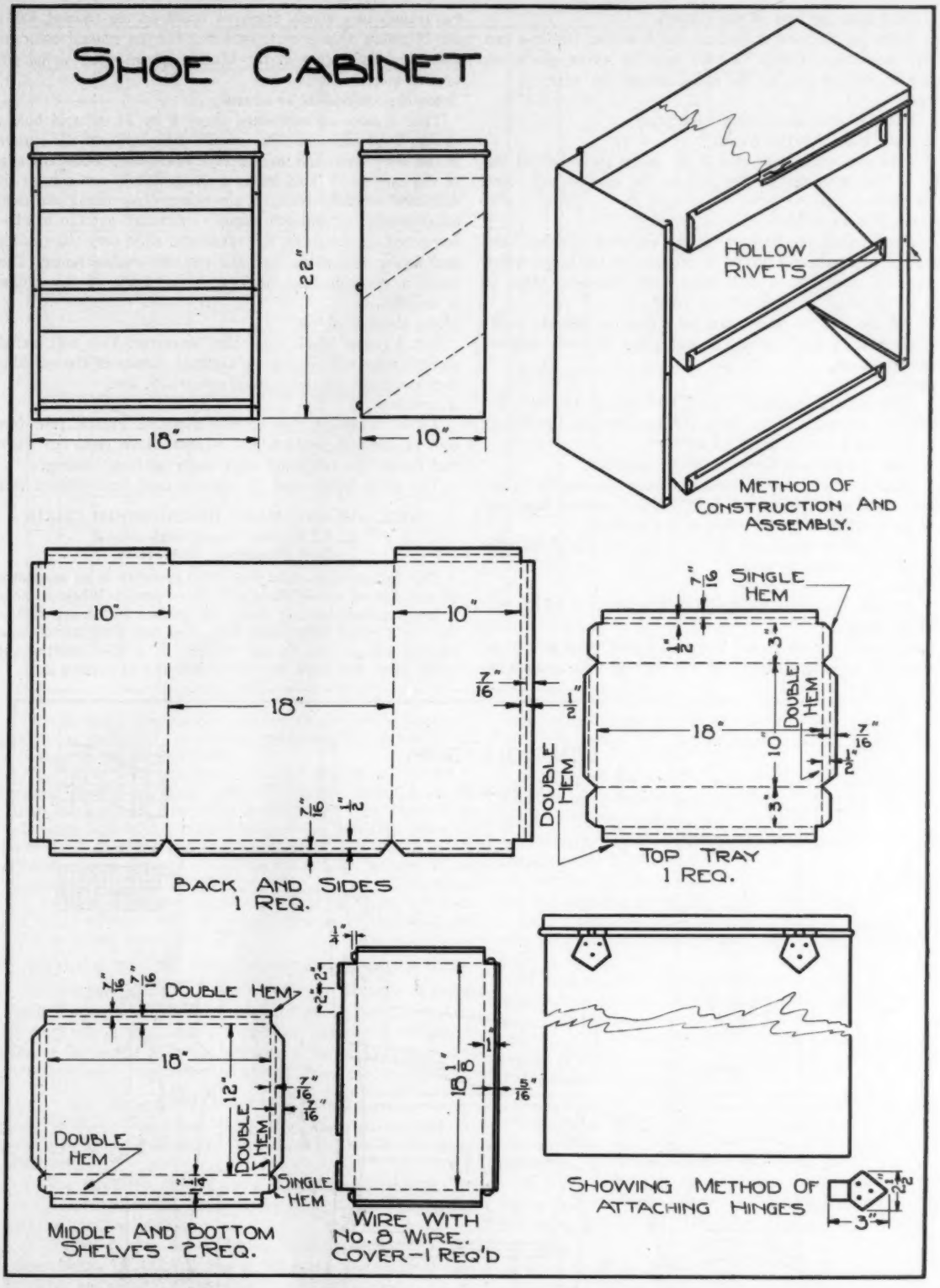
5. Fold for front edge of shelves 1¼ in. on the cornice brake. Show the instructor first how you are going to do this.

Top Tray

1. Lay out the top tray according to the blue print. Show instructor your layout. Cut to the marks.
2. Fold 7/16 in then ½ in. on the bar folder, for the hem on the front and back edges.
3. Fold the end edges of the bottom 7/16 in.
4. Now fold the end edges of the bottom and end edges of the front and back 7/16 in. Do not fold too close.
5. The fold can now be made for shaping up the front and back of the tray. Fold so that the hems are on the outside.
6. The tray can now be slipped in place on the top of the back and sides piece. The shoe shelves can also be slipped into place just to get them out of the way.

Top

1. Show instructor the layout. Notice that it is a little



larger than the body of the cabinet, so that it will not bind and the paint will not stick together.

2. Cut out.

3. Fold open folds on all four edges for wiring.

4. Wire the two sides of top piece, then pull wire out of roll. Leave the two ends open fold.

5. Now fold up for the front and ends of the top at right angles by cutting blocks of wood to fit inside the width and length. Clamp these and the metal to an edge of the bench and fold up by hand, being sure that the straight, square edge of blocks comes exactly on the line for folds at right angles.

Note. For quantity production of tops, the cornice brake may be used if adjusted to allow for blocking.

6. Fold over the laps on the corners.

7. After the sides are folded up, finish wiring. Bending two wires, each large enough to wire half the cover, place the pieces in position and set the metal around the wire.

Hinge

1. Lay out according to the blue print.

2. Drill holes for the rivets.

3. Now slip the square end of the hinge piece behind the wire at the openings on the top as far as you can, then bend over.

Riveting Hinges in Place

1. Place top in the position on the assembled cabinet, and using the holes already drilled in the part of the hinge which is exposed, continue to drill holes right through. (Size of hole to fit 14-oz. or ⅛ by ¼-in. rivet.)

2. Put the rivet in place, turn the cabinet so that the heads rest on a solid anvil, stake, or flat piece of iron, and set with a rivet set.

Handle

1. This is to be made of wire. The loops on the ends can be shaped around a stove bolt. The big loop on the handle can be shaped over a beak horn.

Fastening Handle and Front of Shelves in Place

1. Hollow rivets can be used to fasten the handle to the front of the top. Because of their slightly rounded head and easy application, they are better in this instance.

2. Also hollow rivets can be used in fastening front edge of shelves to edge of ends.

Finishing

1. Prepare the metal for finishing by washing it with acetic acid or vinegar.

2. Choose color of enamel. Ivory is a good color as a background for a modern finish and will go well with most other furnishings in a room. Spray or brush on the enamel. Let it set 24 hours. One coat is sufficient for the ground color because the zigzagging of the blue or green spray strips acts as the second coat.

Spray the Strips Blue or Green

Take a piece of cardboard about 8 by 24 in., and hold it in one hand with one edge on the cabinet. Hold the sprayer in the other hand and using a very fine spray, follow the edge of the cardboard. This leaves a sharp line at one side of the strip and a shade effect on the other. Now zigzag the cardboard around at different angles — although not too much — being careful not to let the cardboard slide over the surfaces and smear the work. Let the job set twelve hours. Then apply a decalcomania transfer to the front of the cabinet if desired.

Make Report on Job

Get a report blank from the instructor. This will include an estimation of the cost of material, names of the machines and tools used on the various operations, etc.

Acceptance

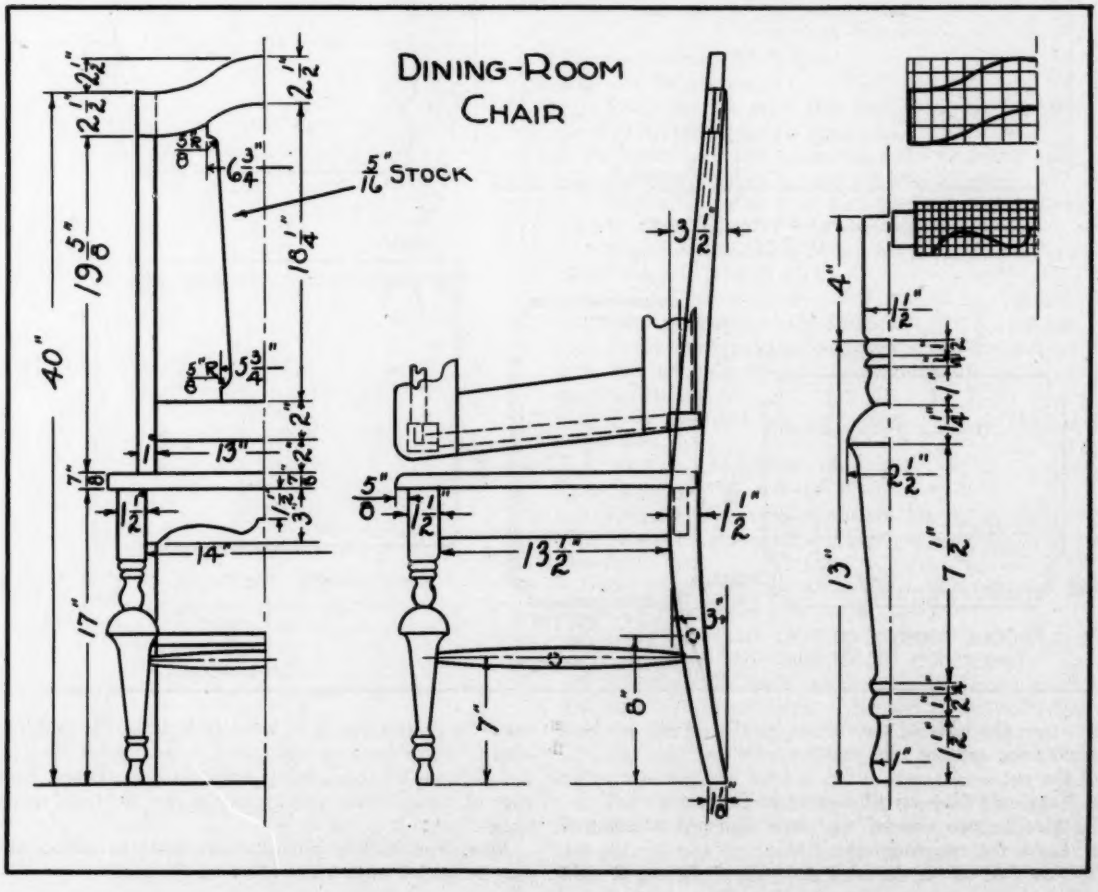
To be accepted, this project must be square, free from tool marks and buckles, and it must have clean-cut wiring and folds. The top must open easily without binding.

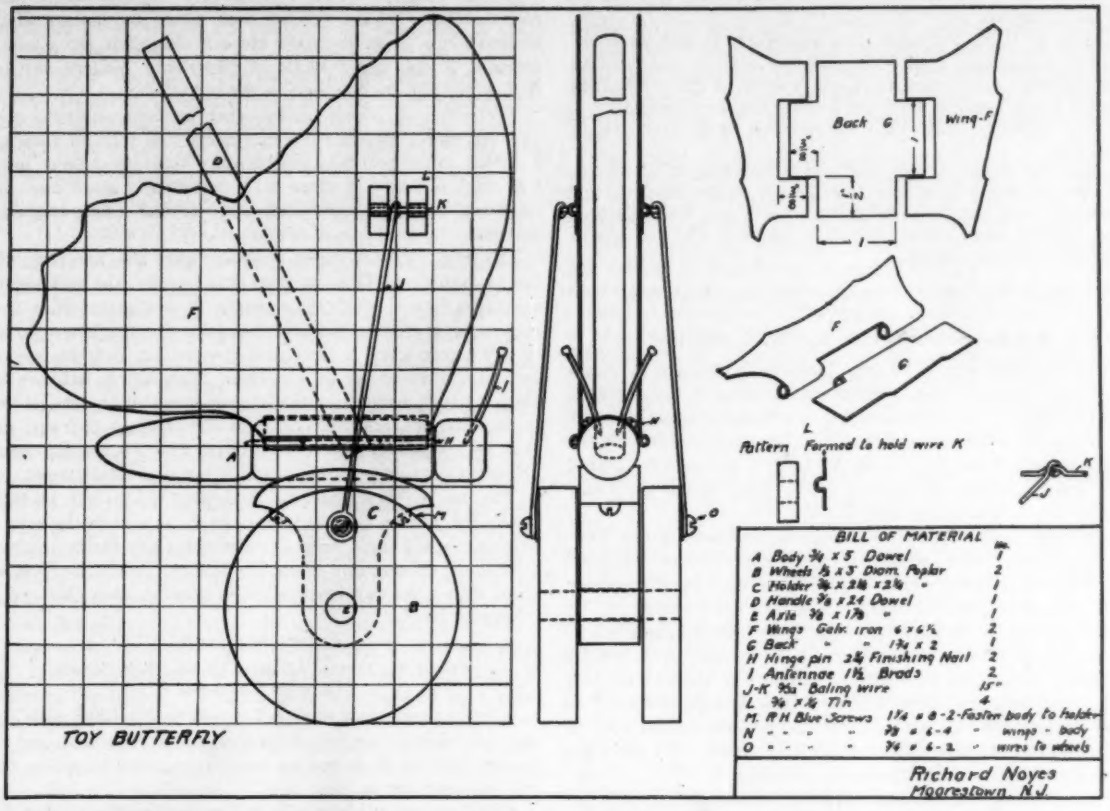
The paint finish must be smooth, neat, and without runs.

WILLIAM AND MARY DINING-ROOM CHAIR

C. C. Sinclair, Senior High School
New Brunswick, New Jersey

The dining-room chair illustrated herewith is an adaptation of a design of the William and Mary period. While it makes a fairly artistic-looking chair, the project is not too difficult for the average high-school boy. Any boy who can do wood turning and is able to lay out and fit a good mortise-and-tenon joint, will have very little difficulty in making it.




TOY BUTTERFLY
Back G
Wing-F
Pattern Formed to hold wire K
BILL OF MATERIAL
A Body ¾ x 5 Dowel 1
B Wheels ½ x 3 Diam. Poplar 2
C Holder ⅞ x 2⅛ x 2⅛ " 1
D Handle ⅜ x 24 Dowel 1
E Axle ⅜ x 1⅞ " 1
F Wings Galv. iron 6 x 6½ 2
G Back " " 1¾ x 2 1
H Hinge pin 2½ Finishing Nail 2
I Antennae 1½ Brads 2
J-K 35a Baling wire 15"
L ¾ x ¼ Tin 4
M. R.H. Blue Screws 1¼ x 8-2-Fasten body to holder
N " " " ⅞ x 6-4 " wings - body
O " " " ¾ x 6-2 " wires to wheels
Richard Noyes
Moorestown, N.J.

The design is particularly adapted to the use of American walnut or mahogany, or perhaps gumwood may be used with a walnut or mahogany finish.

The job involves the laying out and cutting and fitting of angular mortise-and-tenon joints. The top back rail is fastened to the legs with a modified half-lap joint, the front of the rail being flush with the front edge of the legs. The parts are well glued together and then reenforced with screws which should extend through from the back of the legs. Holes should be drilled so that the heads of the screws will lie below the surface. After the screws are pulled up tight, the holes should be plugged with the same material as the chair and then smoothed down flush.

A STUDY OF ART FOR HIGH-SCHOOL STUDENTS

Art has had, and still exerts a powerful influence in everyday activities. Today this influence asserts itself in the conduct of daily affairs. Mr. Leon L. Winslow, director of art education at Baltimore, Md., has prepared a list of fourteen points to be studied by high-school students. These are as follows:

Ways in Which Art Will Help You

1. Some knowledge and appreciation of art is necessary in nearly every field of work. Art will help you to live more effectively.

2. The desire to express one's thoughts and feelings concretely, is fundamental. Art provides an outlet for imagination and the creative impulse.

3. Works of art are enduring records of high human achievement. Art will help you to endure necessary mechanical drudgery and will stimulate pride in your work.

4. Design is an important factor in manufacturing, engineering, and in industry generally. Art will help you in the technical courses.

5. Art figures very largely today in modern advertising and in business generally. Art will help you in the commercial courses.

6. Do you know that people of all periods and countries have reflected their experiences in the things they made? Art will help you to a clearer understanding of history and geography.

7. Some of the world's greatest thinkers have written extensively on architecture, sculpture, and painting. Art will help you to a fuller appreciation of literature.

8. Design laws are natural laws. Art will help you to a fuller conception of science.

9. Do you know that art is expression in appropriate form? Art will help you to acquire control over materials.

10. Do you know that design is prerequisite to beauty? Art will help you to improve your surroundings, to make life more satisfying.

11. The selection and arrangement of things is conditioned largely by one's sensitiveness to lines, masses and colors. Art fosters the development of taste.

12. Just as art itself implies creation, so does an appreciation of art imply recreation. Art will often help you to employ your leisure more advantageously.

13. Ability to enjoy works of art is today an accepted criterion of culture. Art will increase your capacity to appreciate through an understanding of the difficulties involved, gained by actual experience in self-expression.

14. There is always a genuine need for true artists and art teachers. If you have outstanding creative ability, art will help you to prepare for a distinguished professional service.

TOY BUTTERFLY

Richard Noyes, Moorestown, New Jersey

The plan of the toy butterfly with moving wings, shown herewith, was found to be a very popular problem for seventh- or eighth-grade boys in a general shop.

The wings should be cut out first, using a pattern. Then the backpiece is cut and the hinge formed as shown. A finishing nail makes a good hinge pin, and the metal, after being bent around the nail, should be soldered to it, care being taken that the wing will work easily on the hinge. It

is well to have the nail fixed in the wing section and turning in the backpiece.

After all parts are made and assembled, it will be necessary to experiment a little, in order to get the best position for the wire which runs from the wheels to the wings. The holder for the wire is soldered to the wing as illustrated.

The butterfly may then be painted with lacquers or enamels.

This toy makes a very instructive problem, involving, as it does, so many processes suitable for grade boys—simple faceplate and spindle turning for wheels and body cutting, and shaping sheet metal, soldering, painting, and the use of eccentrics in toymaking.

HOW TO GRADE MECHANICAL-DRAWING STUDENTS

Raymond N. Donelson, Baltimore, Maryland

One of the most troublesome things in the process of teaching mechanical drawing is the proper grading of the students' drawings. Every boy is interested in seeing his grade in order to compare it with the standing of other students, or with the standard which the teacher has set for the course. The teacher can make good use of this interest by showing the pupil how his particular grade has been calculated.

In order to do this, drawing must be analyzed into its component parts — line technique, cleanliness of sheet, lettering, dimensions, accuracy, etc. This division may be made more detailed, or condensed, to suit the individual teacher.

In grading the students' drawings, start with 100 and deduct therefrom a definite number of points for every error against accuracy, improper lettering, etc. Show the student in each case why the points were deducted. Calculating grades in this way enables the pupil to see the faults and shows him what to guard against in the next drawing. The system also helps the teacher to make his grades more objective.

The usual course of study in mechanical drawing does not call for ink work in the first part of the course. Students, however, are interested in making ink tracings, especially if they are allowed to blue print their own work. If then a standard of 90 per cent is set as the requirement for making ink tracings, the student will work for this mark in order to obtain this privilege. If it seems undesirable to have ink tracings made, a good pencil tracing might be substituted.

Another reward which might be offered for good work is to permit students doing acceptable work to use drawing sheets on which the margin lines, cutting lines, and the name of the school have been printed. The printing may be done in the school print shop, or they may be obtained from an outside printer at a small cost.

TEACHING AIDS TO THE INSTRUCTOR OF PRINTING

Adolph L. Juten, Duluth, Minnesota

"Mr. Printing Teacher, do you make use of all of the teaching aids in your printshop, especially those you get free?" It is a well-known fact that we do not half appreciate the value of those things which we get for nothing.

One of the most effective teaching aids I have in my shop is a type-founder's catalog. I have found no better way of teaching type faces, the meanings of families of type, series of type and fonts of type, than by the use of this catalog. Here, too, the boy that is particularly interested in printing can spend many minutes looking at photographs of printing equipment that is not essential in the average school printshop, and after some explanation by the instructor, will have a much clearer knowledge of that machinery or equipment, than hours of abstract explanation without an illustration can give. This catalog also is a very good stylebook to which the boys can refer in setting up new jobs. It is just crowded with information for the printing student.

Another catalog that I have found indispensable in the shop is a paper-sample book. One of the paper firms very obligingly supplied it for teaching purposes. With it came considerable illustrated material on the manufacture of paper. It is valuable, therefore, to the teacher who wants to explain to his students how paper is made. He can also show the students samples of the many kinds of paper and bindery supplies that ordinarily are not used in the school shop.

There are, of course, many other catalogs, sample books, and pamphlets that the manufacturers will send in sufficient numbers to be used as supplementary texts on definite printing subjects. Among these is a particularly good one that illustrates and explains each step of the photo-engraving process.

The large printing offices or newspapers also are very willing to furnish another teaching aid; namely, the privilege of making a tour through their plants. A newspaper office is of particular interest to the printing class. The machinery in use in newspaper work is large and spectacular, and the product is well known to all of the class. Such a trip will net the shop instructor much in the way of samples of cuts, stereotypes, matrices, and monotype, as the business men are anxious to arouse the interest of boys. Photo-engraving establishments also offer an opportunity for class observation.

The use of these teaching aids may add to the teacher's work, but just as the accessories on a car add to the ease of driving, so will these printing accessories add to the teacher's feeling of satisfaction when the students leave his printing class with a greater knowledge of printing than they would otherwise have.

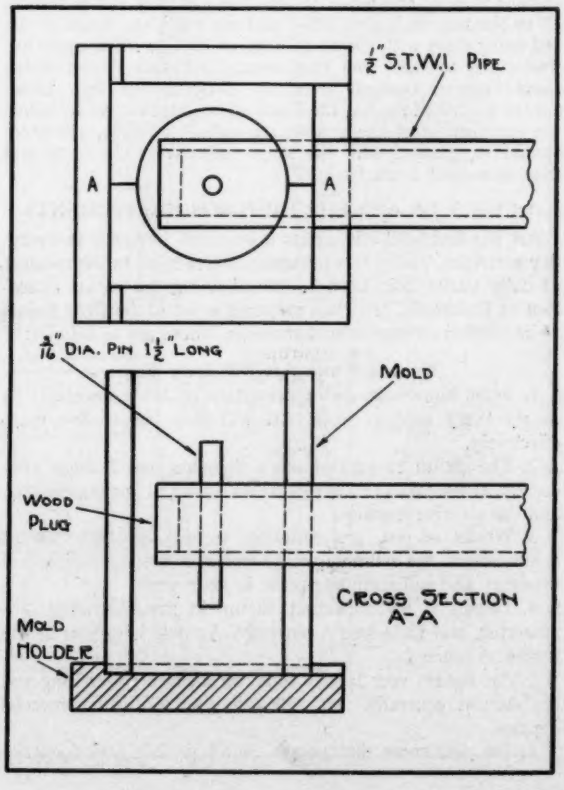
SOFT HAMMER

Frank L. Young, Chaffey Union High School, Ontario, California

A soft hammer is a tool that should be furnished with each tray containing tools for the shaper, milling machine, and the planer. Besides, it should be kept in stock for occasions that call specially for its use.

There are many kinds of soft hammers on the market, but I have found the lead hammer the most satisfactory.

The hammer illustrated herewith can be made and renewed at small cost.



A piece of standard, ½-in. wrought-iron pipe is used as a handle. This, as well as the lead for the head, can be used over and over again.

One end of the pipe is plugged with wood so that the lead cannot run through the handle. A 3/16-in. anchor pin is put through the pipe as shown. With a mold of the type shown in the illustration, one can always have a supply of good lead hammers in stock.

A CLAY-MODELING CLASS

Arthur J. Peel, Brookline, Massachusetts

Clay-modeling is rightly considered as being one of the basic arts, and as such, pupils in technical high schools are encouraged to find the points of contact between modeling and other arts, all of which is sound practice in clay-modeling art classes. It is also a good thing to encourage the students to discover for themselves, by means of research and observation, the wide variety of purposes in which an original model in clay or plasticine is necessary.

But modeling may be an end in itself and serve a very practical purpose by demonstrating in concrete from what might be difficult to demonstrate by argument. As an instance of this, we may refer to the part played by the clay-modeling class in the Providence Technical High School, in demonstrating to the city council, the practicability of converting an abandoned reservoir into a stadium for the Providence high schools. A model of the reservoir was made exactly to scale; the area which was the original basin, was marked out with four baseball diamonds at each corner, and four football pitches in the center. The whole field was inclosed by a running track. The raised concrete banks surrounding the reservoir, provided an ideal foundation for seating accommodation for spectators. Having demonstrated the practicability of the scheme, the class became so enthusiastic that the cost of conversion was worked out carefully and accurately, and the model, with an estimate of the cost of converting the abandoned reservoir into a stadium, was sent to the city hall with a recommendation that the work be authorized. This method proved more convincing than tomes of testimony, or hours of argument.

On another occasion the clay-modeling class desired to express in its own way, appreciation for a new high-school gymnasium, and under the guidance of the instructor, a symbolic plaque was modeled, in which were incorporated the arms of the state, and symbolic figures representing youth at its games. The work was excellent in conception and execution — so worthy, in fact, that it was decided to ask the high school to have it cast in bronze instead of in plaster. But the modeling class declined to ask the aid of the rest of the school, and unanimously decided to carry the whole thing through alone, which it did, and today the bronze plaque, designed, executed, and paid for by the technical-high-school clay-modeling class, is a permanent and artistic record of this esprit de corps on the part of one of its art departments.

Sufficient evidence has already been furnished by the foregoing, to establish the fact that clay-modeling, in addition to being a basis on which to build other forms of art, can in itself be made to express a complete idea and finished purpose, and it is a very good thing to demonstrate this to pupils whenever occasion offers. Too often clay-modeling is looked upon as something merely preparatory to something in which the modeler has no further part nor credit.

NEW OCCUPATIONAL OUTLINE ISSUED BY NEW YORK STATE EDUCATION DEPARTMENT

The University of the State of New York has issued a new Bulletin No. 931, entitled "A Study of Educational and Occupational Opportunity," which seeks to aid teachers and administrators in organizing vocational-guidance instruction in the junior high schools.

The material is presented in the form of an outline for the use of councelors. Its objectives are to assist pupils in orienting themselves to the duties and responsibilities of school organization; to encourage and develop worthy habits of work and conduct; to enlarge pupils' visions of educational and occupational opportunity; to furnish pupils with information regarding school courses and their advantages; and finally, to encourage pupils to remain in school until they are fitted to enter occupational life.

The bulletin is divided into three parts: Part I, dealing with the pupil and his school; Part II, with the pupil and his future; and Part III, with the school and the pupils' future. A selected bibliography on guidance completes the outline.

The bulletin was prepared by a committee, consisting of Mr. George E. Hutcherson, state supervisor of guidance; Mr. Harry D. Kitson, professor of education in Teachers College, Columbia University; Mary Holmes Stevens Hayes, director of vocational service for juniors, New York City; Miss Mildred E. Lincoln, councelor in the Monroe High School, Rochester; Miss Viola M. Reynolds, councelor for the Scotia High School; Mr. H. V. Littell, superintendent of schools at Saranac Lake; and Mr. Frank M. Edson, principal of the South Side High School at Elmira.

NEW YORK STATE APPRENTICESHIP PROGRAM FOR METAL TRADES

The shortage of available apprentices in the metal trades has brought about a return of the apprenticeship system, and the formation of a state apprenticeship training program by the associated industries. In the preparation of the program, coöperation was obtained from the local manufacturers' associations and the educators of the state.

The outline of the program comprises eight divisions: the qualifications of apprentices, including age, schooling; physical characteristics; the period of apprenticeship and shop schedule; trade subjects; rates of pay; apprenticeship agreements; records of progress; and apprenticeship certificate.

A model shop program based on 48 months, or the entire period of apprenticeship, has been prepared. The work in related subjects for machinist apprentices covers 36 weeks a year, four hours a week, for a period of four years. A total of 576 hours will be devoted to such subjects as mathematics, mechanical drawing, related science, accident prevention and hygiene, and economics.

The program has been offered as a suggested basis on which an apprentice school may be operated in any community in the state. The subject matter is ample and sufficiently detailed in character to be of value to any organization which may contemplate the establishment of an apprenticeship training school.

Mr. James Corbett, of Illinois, and Mr. R. B. Shogren, of Pittsburg, Kans., have been employed as instructors on the industrial-arts staff at Oklahoma City, Okla.

Mr. Herman Unruh, formerly of Oklahoma City, Okla., has accepted a position as a teacher of mechanical drawing in the high school at Wichita, Kans.

Mr. James Thompson has been appointed as a member of the vocational-school board at Superior, Wis., to succeed Mr. John Meyett.

Mr. Hugo Rosenkranz and Miss Alta Jensen have been elected as members of the vocational-school board at Oshkosh, Wis. Mr. Rosenkranz succeeds Mr. A. E. Steves, who served on the board from 1924 to 1928.

Mr. Marion O. Grossi, a trained craftsman of Fresno, Calif., has assumed his duties as a teacher in the Alexander Hamilton Junior High School at Fresno. Mr. Grossi had formerly taught in the evening school with considerable success.

NOW, ARE THERE ANY QUESTIONS?

FINISHING RED GUM

905. Q.: (1) Will you please explain how I may finish red gum so as to appear as walnut? (2) Is it possible to give red gum a red cedar finish? (3) What is meant by 6/0 split sandpaper? (4) What is a silex filler?—*C. S. S.*

A.: 1. Red gum to be finished as walnut should be sponged and resanded with a fine paper. Then give a water stain of any standard walnut paper stain using about 4 oz. of dry powder per gallon of hot (not boiling) water. Let dry and size with the shellac-mixing lacquer as mentioned for Philippine mahogany. When dry, sand with a split 6/0 garnet finishing paper. Dust off and varnish as for Philippine mahogany. Since this gum is nonporous, a filler is not necessary, although a deeper tone and heavier color will result if a dark-walnut filler, not over 10 lb. per gallon, is used. Wipe clean.

2. It is not possible to give red gum a red-cedar color, even if the grade known as "sap gum clears" is used. The mottling of sapwood, heartwood, and knots cannot be readily duplicated in a gum-type wood.

3. Finishing papers are both single-surfaced (SS) and double-surfaced (DS) garnet. They are also single thick (ST) and double thick (D). The latter types may or may not be capable of being split by a capable mechanic. In this operation the edge of the paper is rubbed between the thumb and finger until the several layers begin to separate, when the sand face is held in the left hand while the right strips the paper backing of the grit, leaving this attached to a very thin and flexible sheet. This flexibility enables the finisher to cut closer and cleaner without producing the result known as "gumming up" whereby small particles of removed finish make fine glazed specks on the sand face of the paper and thereby scratch the finish. It is better therefore to purchase "6/0 garnet finishing, D.S., ready to split." The sheet can then be torn in eight sheets and each split as required.

4. A silex filler is made from ground silica or quartz, or flint. It is generally ground so fine that it is graded by "water floating," as it is termed in the trade. It has the advantage of being inert to all chemical action; is transparent; is nonabsorbent of the grinding liquid and hence cannot shrink and fall out of the pores as does starch; and it retains to a large extent the needlelike form of the natural crystal, a feature which keeps it locked in the pores of the wood and thereby insures a permanent base for any subsequent finish. No other commercial materials has this combination of desirable characteristics.—*Ralph G. Waring.*

STICKY UPHOLSTERY LEATHER

906. Q.: I have a leather upholstered chair. The leather gets sticky when warm. What can be done about it? —*T. O. McC.*

A.: First determine what causes the leather to become sticky. Did something get on the leather surface which is sticky in itself and should be removed, or is it the finish of the leather itself?

In the former case, wash with a soft, damp cloth and Castile soap. Use Castile soap only, as it does not contain any alkali which will soften the finish on the leather. Rub the surface of the leather briskly with this cloth, then rub off with a moist cloth without soap, and finish by rubbing dry with a clean, soft cloth. The disappearing gloss during this operation will be restored by the friction produced with the dry cloth.

Where the finish is already softened and the leather itself becomes sticky, there is nothing that will harden it again and restore its original finish. The best remedy is to take it off and recover the piece of furniture. Should the upholstery be of the hard upholstered type, where no resiliency is required, the stickiness could be overcome by applying a light coat of pyroxylin finish or a light coat of good shellac. This procedure, however, would not be very practicable on resilient upholstery, as the continuous creasing of the leather would crack the applied coating. — *Herbert Bast.*

POLISHING METAL AND GLASS

908. Q.: Will you please inform me as to where we can secure an economical preparation for cleaning and polishing metal or glass surfaces? — *E. C. D.*

A.: Probably the cheapest preparation would be a mixture of whiting and water. This is applied to the glass with a sponge or rag. When it is dry, it is rubbed off and polished.

A cheap metal polish which is good for brass, nickel, iron, and other metal surfaces, can be made by mixing powdered crocus with kerosene oil to make a paste. This must be rubbed very thoroughly over the article to be polished. The final polish is put on with a flannel cloth which is rubbed over the surface lightly and rapidly.

WHERE TO BUY METAL BOWLS

911. Q.: I would appreciate it if you could give me the names and addresses of companies who manufacture copperized bowls or metal bowls, that I may purchase at a reasonable figure, for some of my students who have made the wrought-iron stands. — *R. J. S.*

A.: We have been able to secure copper, brass, and metal bowls, at about 75 cents upward, each, from one of Seattle's larger department stores. The information given was that their bowls were bought through Geo. Borgfeldt & Co., 16th at Irving Place, New York City. He, no doubt, secures his wares from Connecticut which abounds in factories which specialize in copper drawing, brass spinning, and metal stamping.

Pressed steel mixing bowls which are easily procured from any large department store are a very good substitute if refinished and decorated tastefully. — *Gerald A. Boate.*

VENEER TABLE TOPS

912. Q.: I am making or rather planning to make a dining-room table out of 5-ply veneer. There are some things in the construction of the top that I do not know how to do correctly. Should a molding be glued to the edges and ends or can the edges and end be molded as they are and the sides meeting the edges? — *J. C. H.*

A.: It would be much better to glue the molding to the edges and ends of the table top, instead of molding the plywood, as the core of the plywood would always show through unless you finish the table top by painting or lacquering in colors.

CASTING LEAD

914. Q.: I am teaching patternmaking and we mold our patterns and make castings of lead. Is lead the best material for this or do you suggest some other metal? If so, what are the approximate prices? Could you tell me the grade of molding sand to use for this low melting point metal? — *J. B. O.*

A.: Lead is a good metal to use in connection with pattern shop molding because it has a low melting point, is cheap, and can be procured readily. Its disadvantage, however, is that it has a large shrinkage when cooling. Almost any molding sand can be successfully used for casting lead. The only requirement is that the sand contains sufficient clay for proper bonding and sufficient coarseness for proper venting. Used sand from any foundry where small or medium gray iron, brass, or malleable iron castings are made, is satisfactory. We have used No. 1 Albany sand for casting lead with good success. — *Ralph N. Hurless.*

FEBRUARY MEETING OF THE BOSTON VOCATIONAL SOCIETY

The regular monthly meeting of the Vocational Education Society of Boston was held on Saturday, February 8, at the Hotel Westminster, Boston, Mass. Following the business meeting fifteen new members were elected to membership in the society.

Mr. Bridgman, clerk of the House of Representatives, who was the speaker of the evening, gave a talk on "The Beginning of Legislation in Massachusetts." He traced the history of the country from the granting of the Virginia charter in 1606 and gave some interesting stories about the old landmarks in and around Boston.

The members gave Mr. Bridgman a vote of thanks for his talk, after which the meeting adjourned. — *Louis A. Van Ham.*

THE MICHIGAN SOCIETY OF MANUAL ARTS AND INDUSTRIAL EDUCATION MEETS AT GRAND RAPIDS

The Michigan Society for Manual Arts and Industrial Education will hold its annual meeting April 24, 25, and 26, at Grand Rapids. Mr. L. R. Abbott, chairman of the program committee, has prepared a fine program for the meeting. The headquarters and the exhibits will be in the Hotel Pantlind. In addition to the general session, there will be a number of round-table conferences.

The meeting on Thursday will open with the registration of members and a joint meeting of the several committees in charge of the meeting. An informal dinner will be given, with Mr. George B. Frazee, Jr., acting as chairman. Mr. A. P. Johnson, of Grand Rapids, will deliver the principal address.

At the Friday session, there will be a breakfast meeting of the executive committee and officers. There will be a number of round-table conferences for the discussion of auto mechanics, manual arts, machine-ship practice, mechanical drawing, printing, woodworking, related subjects, and trade education, each of which will be in charge of a chairman. At the general session there will be addresses by Dr. R. L. Cooley, of Milwaukee, and by Mr. H. M. Taliaferro, Grand Rapids.

On Saturday, there will be a general meeting, with election of officers. A meeting of the executive committee will be held, at which the new officers will have charge of the closing business of the session.

The officers have extended a general invitation to the teachers of Ohio, Wisconsin, Indiana, and Illinois, to attend the sessions. The local committee on arrangements has left nothing undone to provide a fine program, excellent accommodations, and comfortable housing for the teachers who will attend the meeting. The last meeting at Lansing was a pronounced success and the meeting at Grand Rapids is expected to be equally successful.

INDUSTRIAL-ARTS TEACHERS OF SOUTHERN WISCONSIN HOLD MEETING

The industrial-arts teachers of the Southern Wisconsin Teachers' Association held their annual meeting February 7–8, at Madison. About 50 teachers were present at the meeting which was held in the Park Hotel.

Prof. Leonard V. Koos, of the University of Chicago, Prof. John Friese, of the University of Wisconsin, and Mr. H. W. Schmidt, of the state education department, addressed the meeting. Mr. Karl Ludeman acted as chairman. The members present voted to renew their membership in the Wisconsin Industrial-Arts Association, which has functioned suc-

(Continued on Page 30a)

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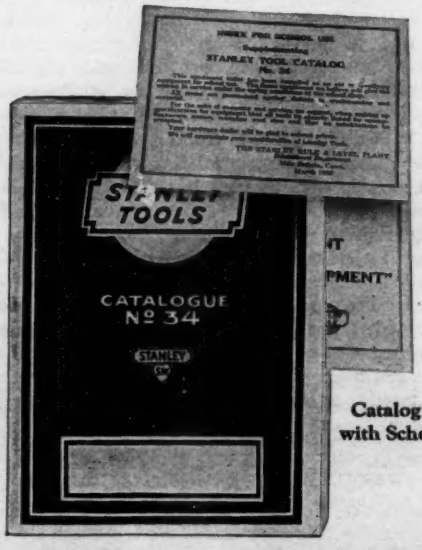

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(Please clip and write name and address in margin below)

(Continued from Page 27a)

cessfully in unifying the aims and standards of the industrial-arts work in the state.

The meeting closed with the election of officers. Mr. Tom Hippaka, of Madison, was elected president, and Mr. R. M. Naset, of Portage, secretary.

THE EASTERN ARTS CONVENTION

The Eastern Arts Association will hold its twenty-first annual meeting April 23–26, at Boston, Mass. The headquarters for the meeting will be the Hotel Statler.

A fine program is being arranged by Mr. Forest Grant, general chairman of the program committee. The general topic of the convention will be "The Importance of the Arts in General Education." In adition to the general meeting, there will be sectional meetings on art, industrial arts, teacher training, home economics, and printing.

The exhibits, while representative of the school trade, will be rather limited owing to limited space. Only 32 exhibitors could be accommodated, with space limited to one booth each.

Mr. Frederick A. Coates, of the Massachusetts Department of Education, will be the chairman of the printers' round table, which will have a morning and an afternoon session on Saturday, April 26. Mr. Wilbur A. Hart, of Medford, Mass., will speak at the morning session on the subject, "Printing in the Junior and Senior High Schools"; Miss Louise C. MacDonald, of Roxbury, Mass., will talk on "The Correlation of Academic Subjects with the Printing Shop"; Mr. John E. Mansfield, of Boston, Mass., will take for his subject, "Handling the Display Job."

At the afternoon session, Mr. F. J. Hartman, of Washington, D. C., will preside. Mr. Richard V. Barry, of Roxbury, Mass., will talk on "Production Methods in a School Shop," and Mr. John B. Curry, editor of *The Trade Compositor,* will discuss "Modernistic Typography."

A CONFERENCE OF PENNSYLVANIA DIRECTORS OF VOCATIONAL EDUCATION

A conference of city directors of vocational education in Pennsylvania was held January 23 and 24, at Harrisburg. Mr. P. L. Cressman acted as chairman of the meeting. The meeting, which is called each year by the state superintendent of public instruction, is for the purpose of getting in closer touch with the problems confronting the vocational directors in the performance of their work and for obtaining the aid and coöperation of the state department in the establishment of working standards.

Mr. Imuel, the first speaker on the morning program, gave a talk on "Safety in the School Shops." Mr. Robert Shaw, deputy superintendent in charge of rural education for the state department, spoke on "The Vitalized Commencement." He solicited suggestions for making all commencements more in keeping with the ideas taught and upheld.

Mr. P. L. Cressman, director of industrial and continuation-school education for the state department, brought up many interesting subjects, which were discussed at the round table. These included the preparation of the state budget, use of nomenclature in reporting industrial courses, federal legislation for industrial education, larger units of administration, problems in administration, and certificate standards for directors, coördinators, and trade-school principals.

Prof. M. M. Walter of Pennsylvania State College gave a report on the analysis of book material in the field of industrial education and presented an outline for evaluating various phases of book material.

An outstanding accomplishment of the meeting was the formation of a city director's association.

OKLAHOMA VOCATIONAL ASSOCIATION MEETS AT OKLAHOMA CITY

The Oklahoma Vocational Association held its meeting in connection with the state teachers' association convention, February 6, 7, and 8, at Oklahoma City.

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The main speaker for the vocational group was Dr. Paul W. Chapman, state director of vocational education of Georgia and president of the American Vocational Association. Dr. Chapman reviewed the accomplishments of vocational education since 1917, pointing out the splendid opportunities in this field for the vocational program.

The meeting closed with the election of officers. Dr. N. Conger, Stillwater, was elected president, Mr. A. H. Abbott, of Oklahoma City, was elected vice-president, and Mr. H. F. Rusch was named secretary-treasurer.—*H. F. Rusch.*

NEW YORK STATE VOCATIONAL TEACHERS MEET AT SCHENECTADY

A meeting of the Eastern District Vocational Association was held at Schenectaday, N. Y., on February 15, at which vocational teachers from Albany, Troy, Cohoes, Scotia, Amsterdam, Schenectady, and Watervliet were in attendance. Mr. Charles Clark, principal of the Schenectady Vocational School, presided. A greeting to the organization was tendered by Supt. W. H. Pillsbury, of Schenectady. This was followed by a summary of the progress of vocational education in the state, by Dr. L. A. Wilson, Assistant Commissioner for Vocational Education, New York State Education Department.

A lecture and demonstration on the photo-electric cell, followed by moving-picture diagrams, was given by Mr. E. L. Manning, research engineer of the General Electric Company. Mr. Ray Ellis, superintendent of the apprentice department of the same organization, then gave a first showing of a film entitled "Opportunity."

The remainder of the program included a variety of entertainment. Before the close of the meeting the incoming president, Mr. Ray Goetz, of Troy, and the treasurer, Mr. Albert Bailley, of Cohoes, gave talks on the development of the association.

ALLIED-ARTS TEACHERS OF ILLINOIS HOLD MEETING

The allied-arts section of the Central Illinois Teachers' Association will hold its annual meeting March 21, at the Art Institute, Peoria, Ill. Mr. L. S. Wood, of Bloomington, will act as chairman.

Mr. Charles A. Bennett, of Peoria, will address the meeting on the subject, "Efforts for Improving Design in School-Shop Projects."

Miss M. Maude Smith, of Bloomington, is in charge of the art round table. Miss Katherine Lester, of Peoria, will lead the discussion on "Art Appreciation," and Miss Marion C. Allen, of the Illinois Normal University, will lead the discussion on "Modern Tendencies in the Teaching of Design."

The industrial-arts round table is in charge of Mr. G. T. Danner, of Peoria. The topic, "A Modern Trend in Industrial-Arts Education," has been assigned to Mr. F. L. Barloga, of Peoria, Ill., and Mr. E. E. Moffet, also of Peoria, will speak on the subject, "What is Expected of a High-School Boy Upon Entering the Industry." — *L. S. Wood.*

A REPORT OF THE NATIONAL CONFERENCE ON AERONAUTICAL EDUCATION

The first national conference on aeronautical education, under the auspices of the Aeronautical Chamber of Commerce of America and the Guggenheim Fund Committee of Aeronautical Education, was held February 17–19, at St. Louis, Mo., in connection with the National Air Show. Mr. Roland H. Spaulding, of New York University, was chairman of the meeting which attracted an attendance of approximately 100 persons.

The purpose of the conference was to establish standards to govern the work being done in the several fields of public-school and university aeronautical education. Three committees were appointed, one dealing with the general phases

(Continued on Page 34a)

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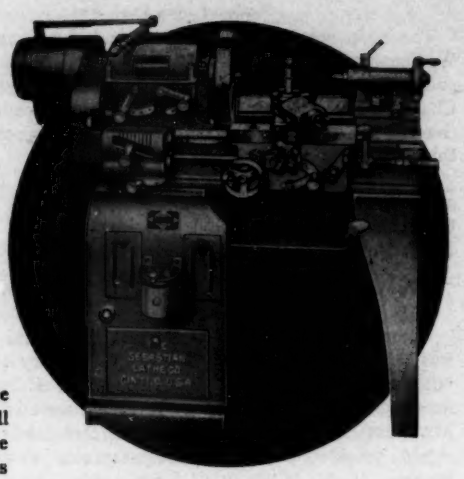

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(Continued from Page 33a)

of aeronautical education in the public schools, one dealing with the ground schoolwork in the technical high and vocational schools, and a third dealing with the engineering phases of the aeronautical work in colleges and universities.

At the first session, Dr. John W. Withers, of New York University, delivered an address on "Some Phases of Aeronautical Education Which Deserve Attention in the Public Schools," stressing the value of having people air-minded with reference to the future development of the new power in transportation. Prof. Earl W. Hill, of the University of California, talked on the work being done in California, giving an outline and suggestive course of study for the state schools. Mr. Andrew D. Althouse, of Detroit, Michigan, talked on some of the difficulties encountered in ground-school education, in which he discussed the content of the courses and gave suggestions on methods of accomplishment. Mr. J. S. Marriott, of the U. S. Department of Commerce, spoke of the uncertain terms in the relative requirements of the workman in the several phases of aeronautical work, in which he emphasized the requirements for employees, operators, and schools in general.

During the Wednesday afternoon session, the several committees on aeronautical education gave their reports and presented recommendations which were approved by the members. The committee on aeronautical education in the schools, of which Mr. B. G. Schackelford of St. Louis is chairman, made the suggestion that the elementary school and junior high school devote their energies to making the citizens air-minded by encouraging the building of model airplanes, both flying and scale. It was also recommended that the high schools offer a definite unit of work covering one semester, with provision for credits the same as any other high-school course. The committee on aviation ground-school education, in charge of Mr. W. H. Taylor, of the University of Buffalo, presented an interesting discussion on the phases of operation schools and aeronautics in general. The discussions revealed that a fine spirit of coöperation existed between the representatives of the commercial aviation schools and the public schools, and that the ends to be sought were similar, even though the methods differed in some degree.

Mr. Willis B. Haviland, director of schools for the Universal Aviation Corporation, speaking before the conference, discussed the cost of operation for aviation schools. The consensus of opinion was, that work done by ground-school students in aviatin should count toward the licensing requirements.

The committee went on record authorizing the appointment of a committee to continue during the next year, this committee to devote its effort toward the completion of a ground-school course. It was suggested that the Aeronautical Chamber of Commerce of America and the Guggenheim Fund Committee, as well as the Federal Board for Vocational Education, be invited to coöperate in the preparation of such courses. The committee which is composed of Prof. W. Harold Taylor, of the University of Buffalo, Mr. A. D. Althouse of Cass Technical High School, Detroit, Mich., and Mr. Ray F. Kuns, of the Cincinnati Automotive Trades School, will present a report of its findings at the next annual conference to be held in 1931.

VOCATIONAL CONFERENCE AT MUNCIE, INDIANA

Vocational directors and instructors from six cities met in a general conference at the Central High School, Muncie, Ind., with representatives present from Kokomo, Anderson, Newcastle, Richmond, Marion, and Muncie.

The meeting, which was the third of a series of six held over the state, took up problems confronting school vocational departments, including the best type of vocational-training program. Other topics discussed concerned the supervision of trade courses, training-school standards for meeting the need in jobs open to boys, and adapting conditions in the shop to those found in the factories.